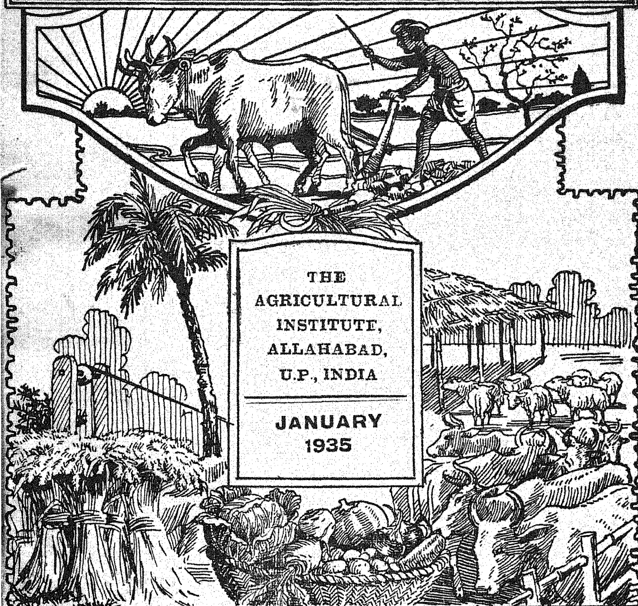
VOL. IX] [No. 1

THE ALLAHABAD FARMER

A bimonthly Journal
OF
Agriculture and Rural Life



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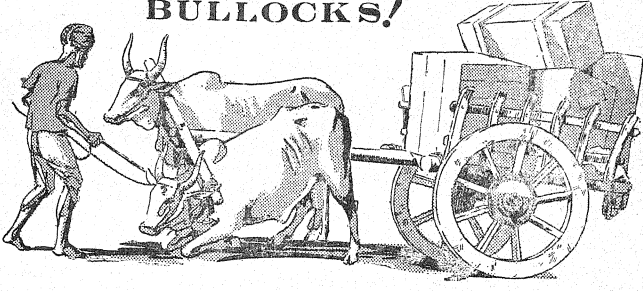

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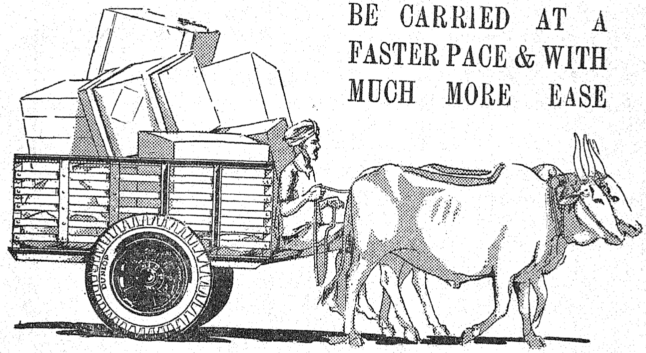

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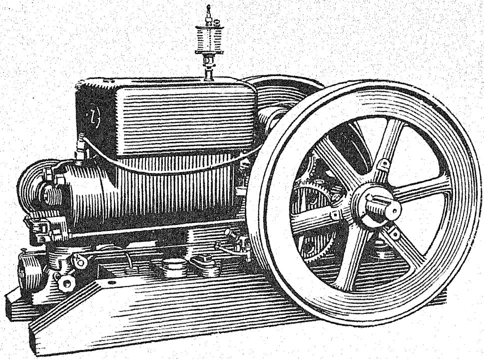

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The Allahabad Farmer

A BIMONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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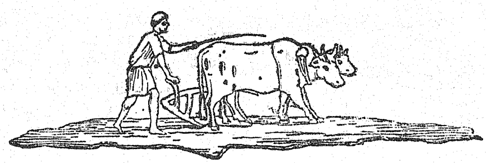

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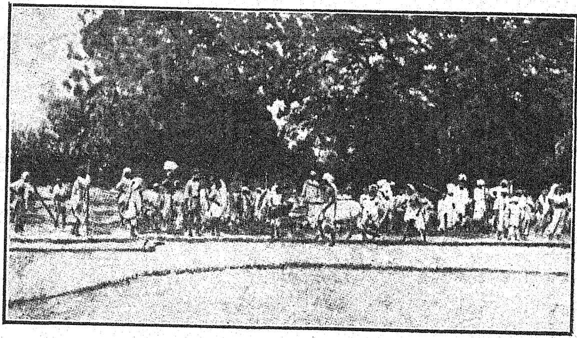
THE WAH-WAH PLOUGH IN ACTION



PLOUGHING DEMONSTRATION

SERAI AQIL

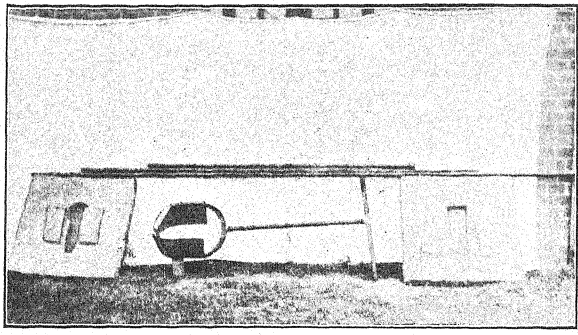
District Allahabad

The Wah-Wah plough continues to win favour and users —"better than medals and prizes; it is being bought in increasing numbers for actual use."

See Vol. VII, No. 3, May, 1933, of *The Allahabad Farmer* for a description of the "Wah-Wah" plough.

See the advertising section of the current number for particulars regarding cost.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

THE ALLAHABAD FARMER

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Editorial

Sir Malcolm Hailey on the Allahabad Agricultural Institute

"I have now for some years had a close acquaintance with the work of the Agricultural Institute, the Holland Hall University College, and the Ewing Christian College at Allahabad. It was a great step forward when these three institutions were brought under a single governing board, and there are many evidences of advantage thus obtained in enabling them to use their resources and equipment to the best advantage. The work they are now doing is of the greatest value to the province, and this has been fully recognized both by the local Government and by the University, which is of course an independent body on which the non-official Indian element greatly predominates. Ample proof of the appreciation of the University was afforded by the recent negotiations for the admission of the students of the Agricultural Institute to the B. Sc. course, when the desire of the University to take advantage of the teaching system given at the Institute overcame the obstacles presented by the University Act. It appears to me that institutions of this nature will have an increasing value in the conditions arising under the new Constitution, for in proportion as the official European element declines in strength in this country with the growth of responsible government, the greater will be the need to maintain the contact with Western culture and influences which institutions of this nature afford. The three combined institutions are now asking for a grant of Rs. 1,75,000 non-recurring and Rs. 71,000 recurring in connection with the scheme put forward as the result of the Lindsay Commission on Higher Christian Education. I sincerely hope that that appeal may receive a warm support." *M. W. Hailey, Governor United Provinces.*

The above statement made recently by His Excellency the Governor of these provinces speaks for itself of the high regard Sir Malcolm Hailey has for the good work the three units of the Allahabad Christian College are doing for the furtherance of the cause of education in these provinces. After having seen the Agricultural Institute for the first time after its union with the other units—the Ewing Christian College and the Holland Hall University College—Sir Malcolm, like all of us, must have noticed how greatly strengthened the Institute is and how much better it is doing its work for the development of Agriculture in this country.

The Marketing of Agricultural Products

The problem of the marketing of farm products is one of the most difficult problems with which a farmer has to deal. In spite of the fact that the world can produce more per acre or more per man than what it could even a few decades ago, there are still millions in India who now go on insufficient food. In spite of the fact that we have learned to grow two blades of grass where one grew before, there are millions and millions of people in this country who do not know what it is to have their hunger satisfied. There is therefore no doubt that our system of distribution is faulty. Marketing is still far from being scientific. The intermediate distributing process is wasteful and expensive. And a poor Indian cultivator, steeped in ignorance, loses in a day through faulty or indifferent marketing all the profits which were gained by thrifty and efficient management over a lengthy period of the growing season of the crop. The marketing of perishables in particular offers great opportunities for costly errors. The whole bulk of many agricultural products is harvested during one short period in the year. This causes very great seasonal fluctuation in the prices of most farm produce. Thus prices often drop by 50 per cent or more in less than a week.

We believe that the problem of marketing therefore requires careful study and investigation if the lot of the Indian farmer is to be improved. Of course a farmer himself can do a great deal for the improvement of the marketing methods by sorting and grading his produce more carefully than he is doing at present, and the grades of certain farm products, like cotton and fruits of various kinds, would have to be defined. We believe also that there is much room for improvement in the transport of farm products. The creation of facilities for handling perishables, the use of refrigerator cars, the speeding up of carriages in transit, all these will help considerably towards the improvement of the marketing of farm produce. We further believe that co-operation amongst farmers in the marketing of perishable goods would go a long way to the solution of the problem. Associations of farmers or growers, such as the California Fruit Growers in America, and the Southern California Fruit Exchange have done much to reduce the cost of marketing from 10 per cent to 3 per cent of the selling value.

Co-operative marketing provides for the carrying of the crop throughout the year through proper storage facilites. Co-operation also provides the necesssary capital for carrying the crop. In co-operation therefore lies the salvation of the farmer. But co-operation need not be confined to sales. Through co-operative agencies the farmer may become a wholesaler in buying as well as in selling. In this way some of the more expensive farm machines, for example, may be made available to the farmer.

We have also learnt with much gratification that the Government is on its way to starting a marketing bureau staffed with highly qualified marketing officers. This bureau, we hope, by careful investigations, will gradually lay before the farmers of this country a scientific method of marketing, and a basis for a scientific correction of the real defects and abuses which now exist in the system of marketing of farm products.

* * * *

Sir Malcolm Hailey

His Excellency Sir Malcolm Hailey visited the College buildings and farm of the Allahabad Agricultural Institute on the 14th November, 1934. This is the second time during his regime that His Excellency has paid an official visit to this Institute. Sir Malcolm was very much impressed with the development of the College since he first visited it in 1928. As he went through the class rooms and the farm his very keen interest in everything that was shown to him was very evident. As he stood on a heap of manure with Dr. Higginbottom, the Principal of the Agricultural Institute, one could see that His Excellency has the interest of the Indian villager at heart. As he bent down from his towering height to examine the compost heap, one could not help a feeling that here was a Governor who would not hesitate to stoop down in the service of the down-trodden and the suffering masses of India.

* * * *

Nitrification in Tropical Soils.

It is a common practice amongst the farmers of this province to plough the land several times before the sowing of *rabi* crops. No theory has been given which adequately explains this practice which has been followed from time immemorial.

Recently S. P. Tandon and N. R. Dhar of the Allahabad University have published the results of their investigations in the September (1934) issue of the Journal of Soil Science. According to the writers of that article, the bacteria which are responsible for the formation of Nitrogen, the nitrite formers, thrive best at a temperature of 95°F. Now since the soil temperature in tropical countries in summer markedly exceeds the optimum temperature,—Leather, working at Pusa, stated that the maximum temperature at Pusa may rise to 158°F at the soil surface and 140°F at a depth of one or two inches,—therefore nitrification in tropical soil cannot be mainly due to bacteria.

(Continued on page 5)

VISIT OF THE GOVERNOR TO THE AGRICULTURAL INSTITUTE

BY RAM NAMA PRASAD, B.A., LL.B.

President of the Higginbottom Association

I would certainly have missed a great deal if I had not availed myself of the courtesy of Dr. Higginbottom when he invited me to be present for the Governor's visit on the 14th of November, 1934.

While within the Institute compound no special prepartion in anticipation of the Governor's visit could be seen (except perhaps that all of the departments were at work at the same time for demonstration purposes), quite a difference was noticeable outside of the compound. The District Board had taken good care to make the road from the Jumna bridge to the Institute worthy of the tyres of the Governor's car. The policemen posted at various places seemed quite active. The presence of the Commissioner of the Allahabad division at the Institute at about 7-30 a.m. was itself an announcement that the head of the Provincial Government was soon expected.

Dr. Rice, the Principal of Ewing Christian College, after looking at his watch, had hardly finished his sentence that 'it is about time for the Governor to arrive' when the white car with the pilot car in front of it became visible.

Dr. Higginbottom introduced several persons including myself to the Governor but, from this time on, the rest of the visit seemed to be that of Sir Malcolm Hailey rather than of the Governor of the United Provinces.

The first department that attracted the attention of the esteemed visitor was the dairy. Students working there, wearing neat and tidy white shorts and Gandhi caps, gave a demonstration of how dairy products are cleanly prepared and kept. They received adequate appreciation, not in the hope of a written certificate nor even by a pat on the back, but Sir Malcolm immediately placed an order for some Institute 'dahi' for his breakfast that morning at Government House. It was supplied at once. As a result of this visit, the Governor has placed an order for 'dahi' from the Institute daily as along as he stays in Allahabad and also for his residence in Lucknow.

The animals, the fodder, the orchards, and the workshop so greatly interested the Governor that Dr. Higginbottom had very politely to rush him through and once humorously invited him to "talk as we walk."

At the end of the tour at Dr. Higginbottom's bungalow, it was quite noticeable that the Governor had been amidst the "Glorious Gwalas and Malis" in their outdoor operations for when the students insisted on a group photograph with the distinguished visitor and Lady Hailey, Lady Hailey smoothed the hair of Sir Malcolm with her hand to improve his appearance for the photograph. Lady Hailey, who had been with Mrs. Higginbottom to the Leper Asylum and who had described the morning's visit as most interesting, agreed with Mrs. Higginbottom that the river bank where the Institute is situated is much better suited for the location of a Government House than the site of the present one in Allahabad.

When the visit was over, Dr. Rice asked me whether, in going with the Governor over the farm, I had had my morning exercise. I had to admit that I had had quite enough of it. So much so that if I were offered the Governorship I would have to decline it on the grounds that, apart from being a politician, it evidently requires an expert knowledge of agriculture and the ability to do a lot of walking at one stretch on visits such as this one to the Agricultural Institute.

(Continued from page 3.)

Now, the amount of nitrate in the soil has been found to reach its maximum in summer, and as most of the bacteria are likely to be killed by the high temperature prevailing in the soil, it is concluded that light and air play an important role in nitrification in soil. That is photo-oxidation and not bacterial activity explains the rise and fall in the Nitrogen content of the soil which in India is at its maximum during the months of April, May and June and minimum in the winter months, that is December and January. Hence the practice of ploughing several times during the summer increases the surface area of the soil exposed to sunlight and also increases aeration or the supply of oxygen to the soil and consequently increases the nitrate content of the soil.

Ploughing deep in the early summer and leaving it cloddy is therefore a practice to be recommended, as this also exposes a larger area of the soil to air and light.

Sprouting of potatoes can be speeded up by a month or more if the whole or cut dormant potato tubers are treated with carbon dioxide.

A STUDY OF BULLOCK

The importance of bullock labour in Indian agriculture has here. Bullock labour is one of the factors which enter into the estimating the cost of bullock labour when costs of producing the way of finding out actual costs of maintaining bullocks. To importance. Whether that cost is low, high, or proper is a second- study and thorough investigation into a business. In modern impunity. Having the above facts in view we are giving here the Farm bullocks for the last five years—1929 to 1934—as follows:—

Table

Items of Cost.	June 1929 to May 1930					June 1930 to May 1931					June 1931	
Roughages:	Mds.	srs.	Rs.	a.	p.	Mds.	srs.	Rs.	a.	p.	Mds	srs.
1 Silage ..	972	0	362	8	0	2,760	0	910	2	9	3,048	0
Green grasses ..	1,473	0	205	11	3	2,072	0	177	12	9	3,323	0
Fodders ..	257	33	155	5	9	379	12	109	4	3	70	12
Dry grass ..	..		..			120	0	26	12	0	57	10
Wheat straw ..	20	0	13	5	3	..		..			..	
Total Roughages	2,723	4	736	14	3	5,3[illegible]1	12¼	1,223	15	9	6507	22
2 *Concentrates:*												
Grain ration ..	381	23	1,414	13	9	675	34	1,829	2	3	7[illegible]1	30
Oil Cakes ..	154	3	485	15	3	247	32	618	0	0	274	0
Salt .	18	9	55	6	9	20	20	60	9	0	34	39
Total Concentrates	553	35	1,956	3	9	944	6	2,507	11	3	1,100	29
3 Labour	..		580	13	0	..		645	9	3	..	
Water	..		120	0	0	..		140	1	9	..	
Medical	.		11	1	6	..		76	14	0	..	
Shoeing	..		75	0	0	..		92	0	0	..	
Miscellaneous ..	..		50	13	3	..		82	5	9	..	

POWER ON THE FARM

been so well understood in India as not to need any great emhpasis cost of production of crops. Several simple methods are used for crops are calculated. However, so far very little has been done in ascertain the actual cost based on complete figures is of primary ary consideration. Cost accounting offers a chance for intelligent farming, business principles and practices cannot be ignored with complete costs of maintaining the Allahabad Agricultural Institute

I.

to May 1932	June 1932 to May 1933		June 1933 to May 1934		Average per year.	
Rs. a. p	Md-srs.	Rs. a. p.	Md-srs.	Rs. a. p.	Md-srs.	Rs. a. p.
1,056 13 6	5,993 20	2,534 9 9	6,849 0	2,533 0 0	3,924 20	1,479 6 9.6
257 13 0	2,221 0	211 4 3	1,400 0	120 0 0	2,097 34	194 8 3
41 6 9	126 20	39 4 9	..	..	168 23	69 3 1
14 5 0	..	..	..	..	35 18	8 3 5
..	4 0	3 0 0	36 0	20 7 9	12 0	7 5 9
1370 6 3	8345 0	2788 12 9	8285 0	2673 7 9	6238 15.5	1,758 11 3.6
1,767 9 3	941 0	2,224 6 0	872 20	2,352 10 6	732 21	1,917 11 8
610 7 0	242 8	572 14 0	182 20	354 6 6	220 4	528 5 4
91 10 6	27 7	79 9 9	27 1	73 8 3	25 23	72 2 5.4
2,469 10 9	1,210 15	2.876 13 9	1,082 1	2,780 9 3	978 9	2,518 3 5.4
838 7 9	..	690 4 0	..	713 5 3	..	693 11 0.6
165 0 0	..	122 12 0	..	108 11 6	..	131 5 0.6
261 0 0	..	89 8 0	..	1 15 0	.	88 1 3·6
108 0 0	..	123 0 0	..	146 12 0	..	108 15 2·4
65 5 0		62 14 0		109 13 0	..	74 3 9.6

Table

Items of Cost.	June 1929 to May 1930		June 1930 to May 1931		June 1931
Roughages:	Mds. srs.	Rs. a. p.	Mds. srs.	Rs. a.	Mds. srs.
Depreciation ..	..	116 0 0	..	..	
Interest	..	121 3 3	.	107 3 3	..
Rent of barn ..	..	160 0 0	..	160 0 0	..
Total	..	1,234 15 0	..	1,304 2 0	..
4 Total costs ..	..	3,928 1 0	..	5,035 13 0	..
	Per day	In the year	Per day	In the year	Per day
5 No. of oxen fed ..	30	10,950	34	12,410	34
No. of Workable ..	23	8,395	25	9,125	30
No. of Worked ..	13.15	4,998.5	15.1	5,510	18.082
	Cost per day.		Cost per day.		
6 Per bullock fed ..	Rs. a. p.		Rs. a. p.		
Per bullock workable	0 5·74 0		0 6·5 0		
Per bullock worked ..	0 7·48 0		0 8·83 0		
	0 13 10 0		0 14·623 0		
	Bullock income for the year.		Bullock income for the year.		Bullock ... the
	Rs. a. p.		Rs. a. p.		
7 By labour ..	3,593 2 0		4,094 0 0		
By manure ..	120 0 0		150 0 0		
By appreciation	..		21 9 6		
Total ..	3,719 2 0		4,265 9 6		

NOTE.—In the above lateral column 3, labour includes the proportionate share of annual inventories of bullocks; interest is calculated at 8 percent on the annual This 8 percent includes 2 per cent depreciation, 2 per cent maintenance and

I.—*(continued)*

to May 1932	June 1932 to May 1933		June 1933 to May 1934		Average per year.	
Rs. a. p.	Md. srs.	Rs. a. p.	Md. srs.	Rs. a. p.	Md. srs.	Rs. a. p.
130 8 0	..	..	..	155 0 0	..	80 4 9.6
97 9 6	..	108 0 0		121 7 0	..	111 1 5.0
160 0 0	..	160 0 0	.	160 0 0	..	160 0 0
1,825 14 3	..	1,356 6 0	..	1,516 15 9		1,447 10 7.4
5,665 15 3	..	7,022 0 6	..	6,971 0 9	..	5,724 9 4·4
In the year	Per day	In the year	Per day	In the year	Per day	In the year
12,410	36	13,140	48	17,520	36·4	13,286
10,950	33	12,045	38	13,870	29·8	10,877
6,600	22.3	8,136	27.15	9,910.5	19.16	6,991
Cost per day.	Cost per day.		Cost per day.		Cost per day.	
Rs. a. p.	Rs. a. p.		Rs. a. p.		Rs. a. p.	
0 7.3 0	0 8.55 0		0 6·48 0		0 6.9 0	
0 8.28 0	0 9.33 0		0 8·04 0		0 8·4 0	
0 13.74 0	0 13.80 0		0 11·25 0		0 13·2 0	
income for the year.	Bullock income for the year.		Bullock income for the year.		Bullock income for the year.	
Rs. a. p.	Rs. a p.		Rs. a. p.		Rs. a. p.	
4,928 12 0	5,929 8 0		7,247 2 0		5,159 11 2.4	
150 0 0	180 0 0		240 0 0		168 0 0	
..	168 0 0		..		37 14 8.4	
5,078 12 0	6,277 8 0		7,487 2 0		5,365 9 10.8	

supervisors' pay; depreciation represents the actual figures of difference between the inventory value of bullocks; rent of barn is calculated at 8 percent on its original value. 4 percent interest.

The above figures as treated in Table 2 will give the reader an idea of the relaton of each factor of cost to the total cost.

Table II.

Item of cost.	1929-30	1930-31	1931-32	1932-33	1933-34	Average per year.
	Per cent.	Per cent.	Per cent	Per cent	Per cent.	Per cent.
Roughages ..	18·78	24·31	24·18	39·72	38·34	30·7
Concentrates ..	49·80	49·80	43·60	40·97	39·90	44·0
Labour ..	14·80	12·81	14·80	9·82	10 23	12·1
Water .	3·05	2·78	2·91	1·75	1·56	2·3
Medical ..	0·27	1·53	4·61	1·27	0 03	1·5
Shoeing ..	1·90	1·83	1 90	1·75	2·11	1·9
Miscellaneous ..	1 30	1·63	1·15	0·90	1·58	1·3
Depreciation ..	2·95	..	2·30	..	2·22	1·4
Interest ..	3·08	2·13	1·73	1·54	1 73	2·0
Rent of barn ..	4·07	3·18	2 82	2·28	2·30	2·8
....	100·00	100·00	100·00	10·000	100·00	100·0

The above table shows that feed is the most expensive item of the total cost, forming about 75 per cent. on the average. The next big item is the labour cost. It should be borne in mind that money cost has a changeable character, depending upon the prices of commodities and the rate of wages at a given time in any locality. For instance, compare the cost of roughages in the above table. There is a big difference between the years 1929-32 and 1932-34. In the latter two years they became expensive chiefly because of scarcity of rainfall and consequent deficiency of fodder. The cost of concentrates has been much less changeable than that of the roughages because of the wider market and longer period of marketing for grains than for green roughages. However, the concentrates also were more expensive in the former two years than in the latter ones.

Feeding of bullocks: Grasses are fed mostly during the rainy season, that is, July to September. Jowar silage forms the main roughage feed for the rest of the year. The other roughages, that is, dry grasses, straws (Bhusa) and Lucerne, Napier and Guinea grasses are given occasionally as a matter of farm-economy. For concentrates we provide mostly ground grain and barley in the

proportion of 2:1; sometimes we provide also maize, *jowar*, *bajra*, *arhar* and other grains as a matter of farm-economy. By farm-economy I mean that at certain times in the year certain agricultural by-products are available during the course of farm business which are economically utilized by being fed to oxen. At certain times they are given vegetable leaves and vegetables which do not have sale value, and other coarser stuffs out of which they pick what they like. The rest after being used as bedding goes to the manure pile. We provide linseed, till and mustard oilcakes, the former two being the major portion of the cakes. Salt is given daily as a mineral. It stimulates appetite and increases the palatability of the feeds.

Ground grains, oilcakes, and salt are soaked in water, for about two hours before feeding. We have two buckets of equal capacity. In front of each bullock we first place the silage. On this we pour one bucket of the wet and thoroughly mixed grain ration. This ration is then partially covered by silage turned up from underneath. A little more concentrate ration is given to work-buffaloes which are of heavier build, and a little less to the newly-broken young bullocks which are lighter in weight. All the full grown work-oxen are generally given the same quantity. This adjusting of ration presents no difficulty to the men in charge who have been taught by years of daily practice. The quantity of grain ration is increased or decreased according to the work season.

We practice no strict adherence to any scientific feeding standard as the basis of feeding the Institute bullocks. There has been little systematic experiment with, and analysis of, Indian feeds in India for Indian animals. The foreign feeding standards when used for Indian conditions are far from being satisfactory and reliable. Hardly any scientific literature is available on work-bullocks feeding, except for fattening steers. The different feeding standards and other scientific literature available are of help in intelligently and economically feeding and maintaining farm animals, but they are not meant to be blindly followed. One's experience and judgment should have a place in the ultimate decision. After all the bullock itself is the best proof of what and how he has been fed and cared for. However, a well-fed bullock does not necessarily mean an economically fed one. A scientific farmer should frequently check up on his cattle-feeds and try to substitute cheaper feeds for the more expensive ones—cheaper in the sense of food value. The market price of a feed is no indication of its food value. A cheap feed on the market may have as much or more food value than an expensive one. That is where scientific knowledge proves its worth.

Our experience so far shows that *jowar* silage alone is enough as a maintenance ration. However, it is a good practice to continue giving some grain ration to the work-oxen during occasional or temporary periods of off-work. The work-oxen here get off work at least three hours during the middle of the day. The oxen stall is built in such a way that all the oxen, while tied up in the stanchions, can lie and rest with the feed before them so that they can eat when they like. So much roughage is given daily that usually just a little is left till the next morning. With this system of feeding each ox requires from 40 to 60 pounds of silage daily. The drier the roughage is, the more the bulk and the less the weight and vice versa. Concentrates are given to the work-oxen. The concentrate ration varies between 6-8 to 10-12 pounds daily. The food left by the work-oxen is ordinarily enough to maintain the unbroken young calves in excellent condition. On the average about 45 pounds of *jowar* silage and 8 to 10 lbs. of concentrates, such as we give, have been found enough for one working bullock such as ours are, averaging about 1,000 lbs. live weight. Judging from the Wolf-Lehmann Feeding Standard, the feeds we provide seem to fall below the requirements of our bullocks but from the practical point of view, the bullocks have been in quite satisfactory condition except in the year 1929-30. So far our experience has shown that in feeding Indian cattle absolutely according to the foreign feeding standard, there is danger of over feeding and of the feeding being over expensive. It seems that Indian cattle have a higher digestive efficiency than those in Western countries, which may be due to the fact that Indian cattle have been used, for a long time, to poor feeding and hard conditions of living. If this is true, it is a valuable characteristic in the indigenous cattle worth retaining. However, in India the problem to-day is of under feeding. The Indian cattle badly need better feeding and better care.

In the table No. 1 labour includes the permanent services of three attendants—one for giving the feeds; another for removing the dung and bedding, cleaning and helping the former; the third for watching the oxen at night. Besides these permanent men it also includes casual labour—attending sick oxen, grazing during rainy weather and washing oxen, breaking in new bullocks, and so on.

We get the water supply for our bullocks from the Institute tube well with electric pumping. We have a *pucca* tank full of clean fresh water to which the oxen have free access at least four times a day. This water is charged at Rs. 0-8-0 per 1,000 gallons. If we calculate from the vertical col. 7 (table 1), it comes to about 20 gallons per bullock per day. A bullock is said to require 10 to 15 gallons of water for drinking per day. This water has been used

not only for drinking but also for cleaning and washing the barn-floor and tank. Formerly it was also used for drinking and batheing by the farm labourers. However, two years ago, we had a hand-pump fitted in a well for the use of farm-labourers from which they can pump water for themselves.

The medical charges have been the most uneven. In 1930-31 we had inoculations of bullocks against rinderpest. We have had a veterinary doctor for the Institute cattle, whose pay was charged partly to the oxen account at Rs. 15 per month from March 1931 to June 1932, which explains the big difference in the medical charges. Because of rinderpest and some oxen being sick, we required the constant attendance of the doctor.

Shoeing is used mostly for those bullocks and buffaloes which are used for cart work and road traffic. We pay Rs. 0-8-0 each for bullock and Rs. 0-12-0 for buffalo shoeing per month. Shoeing of bullocks and buffaloes requires more skill as regards the driving of nails and has to be more carefully done than that of horses. The hoof-bottom of oxen or buffaloes has a very narrow linear region where shoe-nails are driven, and a slight deflection on the inner side injures the foot and to the outside makes shoes loosely held. During the summer hoofs are hard and there is more wearing down of shoes, so thick shoes are used. During the rainy season, hoofs are soft so that at slight stumbling shoes come off as they are not so strongly held. There is very little wearing of shoes in the rainy season, so that thin shoes are used. Winter is the most favourable time and generally one shoeing lasts for one month. During the summer and rainy seasons for most animals more than one shoeing is required per month.

Miscellaneous expenses include repairs of stanchions, water supply taps, supply of new rope reins, new leather yoke straps, leather whip-thongs, driving sticks, phenyle, kerosene oil, and so on.

Bullocks depreciate in value after the sixth year as they grow old. The young stock appreciate in value till their best working stage. The amount of depreciation has been included in cost, and appreciation in income. Usually the value of a bullock is divided over the estimated years it is expected to be fit for work and each year the value is decreased accordingly. However, the more accurate valuation of a bullock is what he is worth in the open market. So at the time of taking annual inventories of oxen, we keep their approximate market valuation in mind. For instance, for the last few years oxen have been cheap along with other agricultural commodities. The amount of annual depreciation of oxen struck according to the estimated graded valuation would have been much less than their market values and consequently our

inventory value of oxen would not have been correct or fair.

The annual inventory value of bullocks, as of other farm assets and equipment, represents the amount of capital tied up in their value for the year. That capital should earn at least bank rate of interest. So interest on the value of bullocks is also entered as an item of cost.

The lateral column 4 represents the total cost of maintaining bullocks—the total of the feed, labour, and all other costs.

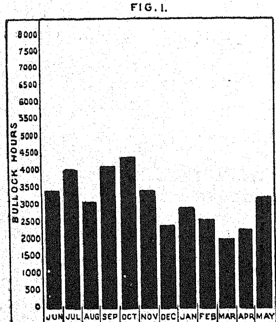
The lateral column 5 gives the total number of oxen fed, workable, and actually worked per day, and per year. The difference between the number of oxen fed and oxen workable is mostly the number of young stock which were not broken for work. The number of oxen actually worked per day is deduced from the total number of oxen that actually worked in the whole year.

The lateral column No. 6 gives the cost per day for each bullock fed, workable and actually worked, as a result of dividing the lateral column 4 by the lateral column 5.

The lateral column No. 7 gives the earned income of oxen. This has been given for the information of the reader but has not much to do with the rest of the figures in the table.

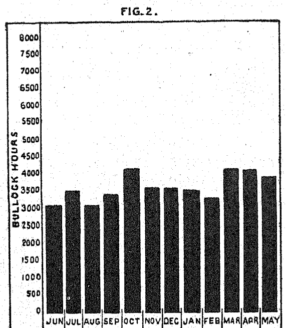
Monthly Distribution of Bullock Labour for the last five years.

FIG. 1.



1929-30

FIG. 2.



1930-31

FIG. 3.

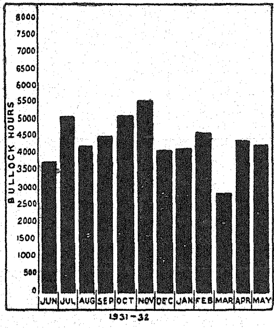


FIG. 4.

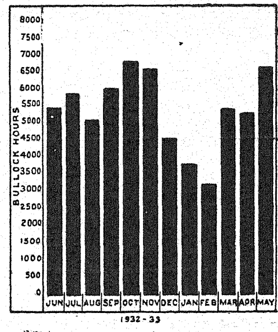
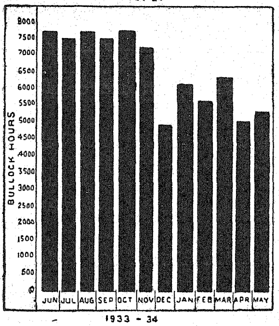
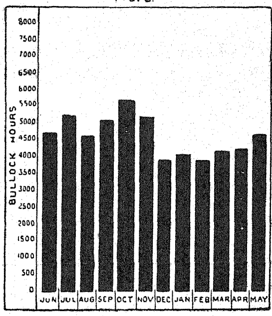


FIG. 5.



A day is taken as of eight hours on the average.

FIG. 6.



Average for the last five years.

The above graphic representations should give a clear idea of the distribution of bullock labour on the Institute farm for the last five years. There has been a steady progress in the employment of bullocks every year. More efficient employment of bullock labour is essentially a part of better farm management. While practically it is impossible to provide hundred per cent employment to bullocks it is possible for each individual farm to locate a definite point where it should be considered that the highest and most efficient

use of bullock labour has been secured. Now if we take the number of workable bullocks in Table I along with the above five annual graphic figures we may arrive at some interesting conclusions as follows:—

	Total no. of Bullock hours.	No. of oxen workable.	No. of hours of per ox per day.
1929-30	38,388	23	4·57
1930-31	44,080	25	4·83
1931-32	52,800	30	4·82
1932-33	65,088	33	5·40
1933-34	79,284	38	5·71

It may be worth while quoting here from a book on Agricultural Economics that "In general, it may be considered that a comparatively full use has been made of horse labour when the average is as high as five or five and one-half hours per day, for there are a number of days in the year when horses will not be used at all." All farm labourers and bullocks here are given rest on Sundays which total to 52 days in the year. Then there are so many festivals—religious holidays when farm work is stopped. There are often several days of heavy rainfall when bullocks cannot be used in field work.

The following is the average cropwise distribution of bullock-labour for the last five years in approximate percentages :

Kharif *crops :	Rabi *crops :	Vegetable and fruits.	Soil reclamation.	Miscellaneous agricultural.	Miscellaneous non-agricultural.
Per cent. 32	Per cent. 27	Per cent. 13	Per cent. 17	Per cent. 3	Per cent. 8

The operations done by bullock-labour are such as seed bed preparation, seeding, making irrigation channels, interculture of mostly vegetable crops and fruit orchards, hauling harvested crops to the threshing floor, silage-cutter and silos, and to the local market for sale. They also include hauling manure to fields, trenching manure and fallow ploughing. In the above figure of 13 per cent as the employment of bullock-labour in vegetables and

*Kharif crops are rainy season crops such as *jowar*, *bajra* etc. Perennial fodder and winter or summer fodder crops have also been included in Kharif crops. Rabi crops are winter season crops such as wheat, barley etc.

fruits, the former engages 10·4 p. c. and the latter 2·6 p. c. Column 4 consists of levelling land, bringing odd shaped pieces of land into proper shape, making *bunds* and *nalas* to prevent erosion. Column 5 consists mostly of purely educational or demonstrational work in agriculture. Column consists mostly of non-agricultural work, such as hauling wood, bricks, building materials, parcels, furnitures and so on.

The steady increase of employment of bullocks may be noted by referring to Table I which works out approximately as follows: (Multiply the number of oxen actually worked by 100 and divide by the number workable).

1929-30 :	1930-31 :	1931-32 :	1932-33 :	1933-34 :	Average for five years.
Per cent. 57	Per cent. 60	Per cent. 60	Per cent. 67·6	Per cent. 71·4	Per cent. 64

The number of workable oxen in 1933-34 increased only by 1·65 times over that of 1929-30, but the number actually worked in 1933-34 increased by 2·06 times over the number in 1929-30. It does not necessarily mean that fewer workable bullocks can be more efficiently employed than a greater number of them on any farm. It requires intelligent planning of field operations and other work in advance so that when rush seasons are over, the bullocks may not be kept standing idle. The question of more employment of Indian bullocks is as important as that of the Indian farmers themselves. India does not need more cattle. It needs to learn how to provide more employment for the existing bullocks and feed them better. Unemployment of bullocks is a definite loss to the farmer. The Indian farmer does know this and that is why he seldom feeds his oxen adequately when he has no work for them; but allows them to go around and damage "other men's" crops. More cultivated land per farmer will not offer the best solution of the present-day inadequate employment of bullocks with the existing system of farming. It is possible by introducing new crops having different planting times from those he has been growing hitherto, introducing crops requiring more cultivation, and doing certain operations with bullock-labour that are now done by hand, and using modern implements. This seems to be a paradox : hired labour though cheaper is more costly than one's own bullock labour though more expensive. In many cases bullock-labour has been made surprisingly cheaper than hired labour by the use of modern implements. For instance, one weeding and one earthing up of potatoes in 1928-29 were costing about Rs. 14 or more per acre by hired labour on the Institute farm, but the same operations done with bullock-harrow and

cultivator, partly with hand labour, have been costing Rs. 6 per acre recently. Suppose, in a certain locality where hired labour is cheap, that the above operations cost Rs. 5 and the bullock-labour the same, Rs. 6. Even then the latter done with one's own bullock-labour, must be considered cheaper. Bullocks, when kept, continue to cost the owner whether they are put to work or not. So the farmer suffers real loss when they stand idle, not when they work. While the use of more bullock power and modern implements will reduce the amount of hand labour in a particular operation, it makes it possible to utilize the labour so released in other operations which the cultivator formerly had been unable to accomplish.

The lateral column No. 6 (Table I) is of great interest. I do not know of any literature on this subject wherewith I could compare these costs. Any local rate for bullock labour gets fixed simply by demand and supply. In October and November near about Allahabad one pair of bullocks including the ploughman can be hired at Rs. 1 to 2 per day, but later in April any number of local bullocks can be had for threshing grains without any cash payment. I doubt if such a rate represents the actual cost of keeping bullocks.

The above are the bare facts and figures on the cost of maintaining and distribution of work of the Institute farm bullocks for the last five years, which if attentively studied and intelligently interpreted can supply much more valuable information than has been possible for me to discuss here. After giving explanatory notes on the facts and figures I have just shown the trend of some possible conclusions having to do with general Indian conditions. Some other important aspects of bullock power on this farm can better be treated later with the study of the cost of production of crops. As Dr. B. H. Schneider's work on animal nutrition progresses in the Institute, we hope to solve certain problems about cattle feeding which have not yet been tackled. We may add lime to the ration of the Institute work and milk stock in the near future. I doubt whether our system of maintaining bullocks has been ideal; yet by the termination of the next half decade we hope to present more facts on this subject, which is of such great importance to India.

S. R. Misra.

About a thimbleful of the oil is all that is necessary. Rub it thoroughly over the hands until tho offending spots are "out"; then without removing the oil, wash the hands in warm water with plenty of soap. The soap takes off the stain and the excess oil, but leaves enough of it to keep the skin soft and smooth."

Science News Letter.

CROP IMPROVEMENT IN INDIA

A review of the Experimental Results obtained in the Agricultural Experiment Stations in India.

BY B. M. PUGH.

One of the greatest achievements of the departments of agriculture in India is the introduction of improved varieties of crops. In 1929-1930 it was reported that the total area under such improved varieties exceeded 13,700,000 acres.

Of the 85,000,000 acres now sown with rice the latest returns indicate that 2,270,000 acres are now sown with improved varieties. In Pusa alone about one hundred and twenty three different strains of rice have been isolated, of which about five different types (9, 18, 24, 31 and 52) are now recommended to the cultivators, of which we may here mention only a few: (1) Type No. 9 bears a medium size grain, white in colour and is generally grown in places where the water rises in the fields during the rainy season. (2) Type No. 18 is also a variety which bears medium size grains. It is a 90 day crop and can therefore be followed by a cold season crop like barley or peas. It is sown in May and transplanted in July. (3) Type No. 24 is a heavy yielder and has yielded about 25 maunds at Pusa. Its grain is white, long and slender. In the Central Provinces also much work has been done for the improvement of the rice crop in the provinces, and the Department of Agriculture of that province is now in a position to recommend to the cultivators certain varieties which have been found to do well in some parts of the province. Amongst those recommended are: (1) Gangi Kuda selection E. B. 17, which is an early variety. The variety is chiefly grown in the Jubbulpore district; (2) Bhondu No. 10, which is the best yielder in the province amongst the medium varieties; (3) Luchai No. 4, which is one of the heaviest yielders among the late varieties and is also of good quality; (4) Chinoor No. 21, which is a scented variety and one of the best rices of the province. Its kernels are long and slender.

Wheat is another very important food crop in India in connection with which much work has been done by the central Research Institute at Pusa and also in various experimental stations all over the country where wheat is a staple crop. In ordinary years the total acreage in India under wheat is about 31,000,000 acres of which about 2,500,000 acres in the Punjab, 1,600,000 acres in U. P. and 660,000 acres in the Central Provinces alone are under improved varieties. In the Punjab a type known as 8 A alone occupies an area of about 2,000,000 acres. Recently a new variety known as C. 518 which in one place has been reported to yield 49 maunds per acre has been recommended to the

farmers by the Punjab Department of Agriculture. In U. P. and C. P. the most outstanding varieties are Pusa 4, Pusa 12 and Cawnpore 13. Of the newer Pusa varieties Pusa 111 is another type that has been tried out in the experiment stations in U. P. and has been found to be a type of outstanding merit comparable to Pusa 4, Pusa 12 and Cawnpore 13, of the improved varieties now grown in the United Provinces. Pusa 111 of all the Pusa wheats has also been found to possess the best qualities for milling and baking. Pusa 114, another very promising variety, is now under trial in Sind and the Punjab.

Barley, another very important crop of this province, also has been the subject of various investigations at Pusa and elsewhere. Several types have been isolated at Pusa, but the most outstanding is Barley type No. 21. This is a very heavy yielding variety and has been reported to yield from 20 to 30 maunds per acre. Another variety which is also in demand is Barley type No. 24 locally known as Ramdana. This is a naked or hull-less barley but it does not yield as heavily as type No. 24.

At present India is second only to Cuba in the amount of sugar she produces, the area under sugarcane being about 3,000,000 acres. Of this area the acreage under improved varieties exceeds 815,000 acres; that is, a quarter of the total area devoted to sugarcane. Much of the work for the improvement of this crop has been done at Coimbatore and the Coimbatore canes now are spreading all over India where sugarcane is grown. Of the many canes that have been tried out in this province the following have been found to be of economic value: (1) Co. 205 (2) Co. 213, (3) Co. 214, (4) Co. 244, (5) Co. 281, (6) Co. 290, (7) Co. 300, (8) Co. 312, (9) Co. 313 and (10) Co. 331.

Coimbatore No. 205 is a cane generally grown in places where soil and climatic conditions are not favourable.

Coimbatore No. 213 is the one that has generally been grown in the province. It is a medium-size cane giving a good tonnage and not likely to lodge.

Coimbatore No. 290 is a variety of cane much in demand in Meerut and the Rohilkhand division. It is a cane of medium-size, early maturing but weak in quality, which requires tying up when well grown.

Of the newer Coimbatore varieties, Co. 312 and 313 have been found to be the best. Co. 312 is claimed to be a good cane not requiring very high standard of cultivation but lodges when heavily manured. Coimbatore 313 is a very heavy yielder. This cane with Co. 312 are both earlier maturing than either 213 and 290.

Of the non-food crops the most important is cotton. A great deal of work has been done in order to improve this crop in several

experiment stations in Central India, the Central Provinces, Bombay including Sind, the Punjab, U. P., Berar, etc. Under ordinary conditions the acreage under this crop in India is about 26,000,000 acres. out of which approximately 4,131,000 acres are under the improved varieties of cotton. In the Central Provinces the variety known as Verum No. 262, which is somewhat resistant to wilt, is the most widely cultivated. But its successor Verum 434 seems even to be more promising than Verum 262, in that the former can adapt itself to variations in soil and climatic conditions better than the latter. In the Central Provinces, a strain known as Bani 306 is also considered superior to E. B. 31, another strain which has more or less established itself in several parts of the province, because of the better spinning qualities of the former. In the Punjab the American varieties known as "4F" and "289F" are amongst the improved varieties that are generally grown in the province. In the U. P. the varieties known as A. 19, Cawnpore 402 and C. 520 are generally recommended where irrigation water is available during the early period of their growth. More recently a strain known as N. T. 43 has been evolved and is being recommended by the Indian Central Cotton Committee. This strain is evolved out of the recently introduced American cottons and is a high yielder, early maturing and is claimed to be jassid resistant. Along with this strain of cotton N. T. 38 and N. T. 45 are also recommended as they also are high yielders and mature early. N. T. 1 which also is a strain evolved out of the American cottons is also a very high yielder although it does not mature as early as any of the other three.

Another very important non-food crop for which much work has been done especially by the Bengal Department of Agriculture, is Jute. The area covered by the jute crop in Bengal and its neighbouring provinces like Bihar and Assam is 25,000,000 acres. The acreage under this crop during the last few years has decreased considerably due to the collapse in prices obtainable for the commodity. The acreage is again on the increase now and with a return to normality it is expected that the jute will again increase. Of the many strains now recommended by the Bengal Department of Agriculture D. 154, a strain of *Corchorus capsularis*, and "Chinsurah green", another strain of *Corchorus olitvrius*, are among the heavy yielders having good quality fibres.

Among the oilseeds grown in India, groundnut is probably the most important. The area sown with it is over six million acres and still continues to increase. One chief reason is that this crop is one of the leguminous plants which increase the amount of Nitrogen in the soil instead of impoverishing it. Hence it has been grown mostly in soils where continuous cropping of exhaustive crops like cotton and *juar* has been prac-

tised for years. Consequently most of the investigation in connection with this crop has been in the Central Provinces and Berar where cotton in one of the most important crops of the province. The varieties that have been most in demand in those regions are the "small Japan", the "Spanish peanut", and a variety known as AK-10. The last is a large-podded variety and bears large nuts, and its yield also is fairly large, it being about 25 maunds per acre. The small Japan and the Spanish peanut yield only about half as much although their oil content is higher than that of AK-10. But a strain known as AK 12-24, which is more recent than any of the above and which has been evolved from the Spanish peanut, has been reported to be as high in the oil-content as the small Japan and the Spanish peanut and yields also more than any of those two.

Another oilseed crop that is gaining much importance in this province is linseed (Hindi—Alsi). It has been found that the linseeds of India fall into two main groups, the bold-seeded types of Central India and the shallow-rooted types of the Indo-Gangetic alluvium. By 1924 Howard and Klan had reported the isolation of 124 different types of which Types No 12 and No. 24 are recommended to cultivators in Northern India; while Type No. 124 is recommended for the black cotton soils of Central India. Further investigations have been made in order to produce types which combine the good characters of the first group with that of the second; and several hybrids have been produced whose yield and oil contents are being tested before they can be recommended to the cultivators of the country. Of these, four hybrids, H. 10, H. 21, H. 55 and H. 68, have been found to be of outstanding merit in that they possess bigger seeds and hence a higher oil content and also yield as high as the types 12, 24 and 124.

Another very important group of crop plants grown in India is known as the "pulses". Of this group, gram (Cicer arietinum) is the most widely cultivated in India. The area sown under this crop in British India is about 11,400,000 acres, of which 4,700,000 acres are in the United Provinces alone. A good deal of investigation has also been done in Pusa in connection with this crop, and already more than eighty-five types have been isolated up to 1931. Several of these types are now recommended to the cultivators some of which are the following: Types 58, 17, 6 and 28. Of these types, No. 58 seems to be the best in that it is one of the heaviest yielders with an average yield of about 30 maunds per acre. Type No. 17 is a variety mostly grown in North Bihar. Among the white-seeded grams the so-called Kabuli grams, type No. 6 and type No. 28, each has an average yield of about 16 maunds per acre. The Kabuli grams therefore do not yield as heavily as the grams with brown or yellowish brown colours.

Arhar *(Caganus indicus)* is another of the many important crops known as pulses and one of the most widely grown in India. Several strains of this crop have been produced at Pusa and elsewhere which yield fairly well and much above the average yield obtained from the local varieties ; yet the problem at present in connection with this crop is to produce varieties which are resistant to wilt, a disease which commonly affects this crop. Among the several types recommended by the Pusa authorities, Type 80 (Arhar) seems to be resistant to wilt. This strain is also a good yielder, having an average yield of about 23 maunds. Some of the other types that have been found to show some resistance to wilt are Types 15, 41, 50 and 51. Type 51 is a fairly high yielder and possesses yellow-brown seeds, which have a better market demand than the other.

WHITE ANTS ON THE FARM

The control of white ants on the farm appears to be at present one of the most baffling problems to the farmers. We have had several inquiries from educated farmers all over the province and especially from those who grow sugarcane as to the best method of destroying white ants in the soil. We therefore give the following directions which are abstracts from a recent circular bulletin which was sent to us by the Agriculturul Experiment Station of the Michigan State College (U. S. A.).

Where a soil is infested with termites all decaying organic matter such as dead trees, decaying logs, should be removed and not left in the soil; and dead wood on recent wounds should be treated with a mixture of one part creosote and three parts kerosene.

Farm manure, crop residues and stubbles of *juar* and maize are also attractive to white ants. Hence they should be removed. Where white ants attack living trees cultivate the soil thoroughly and use commerical fertilizers in place of farm manure. Where the soil is badly infested, continual cultivation or raking up of the soil will destroy them. Deep ploughing and crop rotation are also factors which help to control white ants. After the soil is ploughed deeply it my be treated with the following chemicals:

(1) Sodium cyanide (2 maunds dissolved in 12,000 gallons of water). This will be sufficient for one acre of land.

(2) Carbon disulphide solution. At a soil temperature of 60-70oF and 45 c.c. emulsion to 10 gallons of water Pour the carbon disulphide emulsion into water and stir it. Use $2\frac{1}{2}$ gallons of the diluted emulsion to a square foot.

Where there is no vegetation to be considered an application of kerosene or a 10 per cent solution of sodium arsenite is also very effective.

FARMING AS AN OCCUPATION*

For the vast majority farming offers only a very meagre income. The person who, whether as owner, tenant or farm labourer, earns his food by the sweat of his brow, cannot expect much material return from his work on the soil. Throughout history the man who tills the soil has been near the bottom of the economic scale. Yet throughout history also, thousands have clung to agricultural work, preferring it to the more remunerative occupations. This very love for the soil, and willingness to remain on it to their economic disadvantage, has lowered their position both economically and socially. Had more been attracted into other occupations, there would have been less pressure on the land, and each worker would have received compensation more nearly equal to that given equal labour in other fields. Because the many clung to farming, and the enterprising (or restless) few left, it has been assumed that "anyone can farm", and that those who farm do so because they are incapable of anything better.

There are, however, other reasons why men have preferred agriculture to other occupations. Most important of all perhaps is the joy of watching things grow, and of feeling that one is a partner with God in the eternal mystery of creation. Many are held by their desire for independence, which they lose in the organization and discipline of the modern factory. The farmer may work hard from dawn to dusk, but he determines what work he shall do that day and how he shall do it. Even the hired labourer has a personal, and often a friendly, relationship with his employer in which his opinion is likely to be consulted, and his advice followed.

The good earth itself has a great attraction. Nothing seems to give quite such a sense of security as the ownership of land. Positions may be lost, corporations and banks may fail, even governments may fall, but the land remains, and with it the hope of bread and a roof. He who sells his land may feel rich, but such wealth has a way of disappearing in a surprisingly short time. Through observation, or through the experience of the race, the farmer seems to know this, and obstinately holds on to his land.

Many believe that the farmer's life is more healthful than that of the city-dweller. His is an active yet tranquil life; he lives much of the time in the open air and the sunshine. Many a school debate has proved the advantage of village over city life but the facts are against this conclusion. At present, the resident of the city has a better chance of good health than the villager. Medical facilities are incomparably better. Strangely, and tragically, the city-dweller is able to secure far more healthful food than he whose

*The summary of an address given by Mr. W. B. Hayes in the U.P. Secondary Education Conference.

occupation is the production of food. The supply of fruits and vegetables in the cities is far from adequate and the price puts them out of the reach of many but in many villages they are simply not to be had during most of the year. Milk also is scarce. The villager lives on his diet of grains and pulses, not even aware of the inadequacy of such foods.

Much can be done to improve this situation. Already the medical profession in the cities is being crowded, yet very few doctors are willing to attempt a rural practice. The problem of earning a living from ignorant and poverty-stricken villagers is indeed a difficult one but the need must be met. India cannot afford to allow ill health and a very short average span of life to continue to rob her of her greatest wealth, her man-power.

The problem of proper food is not so difficult. If only the waste water from the house were available for irrigation, this would be sufficient for a small patch of vegetables. This garden could be within the courtyard of the house, protecting it from the village animals. In many villages, one man could raise enough vegetables for the whole village, but prejudice against selling vegetables often stands in the way of this. There is an opportunity for the professional dairyman, but it is also possible for the villager to produce milk for his own family at very little expense. If he does not want the expense and bother of keeping a cow, he can turn to the humble goat. Many will give two pounds of milk a day, and some give eight to ten pounds.

Whatever be the attractions of the farmer's life, few educated young men are willing to consider living on the income of the average farmer. A young man of ability and education has a right to look forward to something better in life than a bare living. What then are the prospects of improving agricultural income?

There are several ways in which the farmer can increase the yield of his land. Improved varieties, such as the Pusa wheats, have added much to the farmer's income. With good seed, proper manuring and cultivation, and economic marketing, the returns from the soil may be increased 25, 50, or 100 per cent. But, asks your prospective farmer, what of that? Even double the income of the average farmer fails to appeal to the young man of some education and ambition.

If farming is to afford a sufficient income for an educated man, it would seem necessary that it be of a different type than that carried on by the average farmer in this country. Along what lines does departure from the methods of the average farmer promise an adequate return?

Perhaps the most obvious departure is that of large scale farming. The average Indian farmer grows the type of crops which can

be grown on a large scale on a very few acres. If he could cultivate a farm comparable in size with those of other countries growing the same crops, he could hope for an income comparable to that of farmers in other countries. It may not be easy for him to get possession of a large tract of land. Ordinarily this will be possible only for those whose families have large *zamindari* holdings. Even they will have difficulty, but the present land laws of the United Provinces make it possible for the zamindar to acquire tenancy rights in order to introduce improved methods of farming.

And improved methods, including the introduction of power machinery, are essential. A former student of the Institute started to farm 1,000 acres of land in Bengal. He learned that to cultivate this tract with bullocks would necessitate such a complicated organization as to be impracticable. Purchasing a tracter, he was able to cultivate his property and even in recent years he has made a fair profit. If the farm is not quite large enough to justify power machinery, the owner may be able to make economical use of machinery by doing contract work for his neighbours.

The alternative to large scale farming, equally logical and more frequently possible, is to grow crops suited to small scale operations. Vegetables require a large amount of hand labour, they produce immense yields per acre, and in India at present, the supply is insufficient. The demand is steadily increasing, as people learn the value of vegetables in the diet. A comparatively small farm still allows its owner to make use of his ability to plan and manage, to employ the labour of others, and to develop an intelligent and economic system of marketing. This means that he has an opportunity to use his superior powers and to earn a superior income.

Fruit growing has a special attraction for the educated man, offering not only a satisfactory financial return, but a challenge to his ability and technical skill. The work is unusually pleasant, and does not tie the orchardist down to the land throughout the year, although he should be present during the cultural operations to direct the work if not to do it himself. Fruit growing has in the past been greatly neglected in northern India, but modern development began in the Punjab several years ago, and has more recently started in the United Provinces, where increased interest on the part of the public has happily coincided with Government activity. The danger is that many will take up fruit growing whose zeal is not matched by their knowledge.

Occupations subsidiary to fruit growing also offer splendid opportunities. At the present time the nurseries of this province are unable to meet the demand for fruit trees. As the industry develops, the man who can supply large quantities of stock of

superior quality will be able to dispose of it at very profitable prices. The canning of fruits and vegetables, and the manufacture of pickles, chutneys, jams and jellies also offers a promising field. During parts of the year, and especially in some years, certain fruits and vegetables are very plentiful, and the price is very low. At other seasons they become very scarce. Preservation is therefore of great economic importance. It may well form a subsidiary industry for the grower or it may be an independent industry. The equipment for canning is expensive, especially if one undertakes it on a large scale. But a beginning can well be made with other forms of preservation, for which little capital is required. The equipment may be increased as the market expands, and may be paid for out of profits.

Dairying is another special type of agriculture which offers excellent opportunities to the educated farmer. The production of sanitary milk would be an ideal difficult for the ordinary *gwala* to achieve, even were it present in his mind. Specialized skill and information are necessary and a fair return can be secured by the man who possesses these. A recent letter from a former student of the Institute tells of his starting a business along these lines beginning with a capital of Rs. 20. His perseverance in the face of discouragement was rewarded, and in a few months he was making a net profit of well over Rs. 50 a month, and already planning a considerable expansion.

There remain those occupations in which others are helped to better methods of farming, and a more satisfying village life. There is an opportunity for a limited number in such work, but it would be a mistake to suggest that the main outlet for agricultural students is to be in these occupations. There should be, and probably will be, an increasing call for teachers of agriculture, but only a minority can look to this profession.

In the increasing programme of rural reconstruction, there is need for men with agricultural training. As this is largely philanthropic work, the financial remuneration is not likely to be great. But as an opportunity for quiet, enduring work for the up-building of India, this may well appeal to some of the finest young men in the country. Many of those who earn their living as farmers will also consider it their good fortune to share with their neighbours their technical knowledge and skill, thus enabling them also to increase their income; and by partaking in the life of the group, to bring to it the inspiration which they have received in and through their education, and to make that life richer and fuller for all.

It is reported that Russia has over a thousand scientists working on problems of crop improvement.

"INJURIOUS AFTER-EFFECTS OF JUAR"

By C. P. Dutt

The Juar is a class of crop which, so far as its production is concerned, fits admirably into the agriculture of India. The advantages of high yields, drought resistance, vitality, and profitableness, have recommended it to the consideration of farmers'. Under many conditions, however, its culture has proved injurious to certain crops following it and especially to the small grains. This injury has been so great under certain conditions that it has impressed upon the minds of the farmers the fact that juar is hard on land. Though the yields of juar itself may be high, the crop sequence of juar followed by a small grain may be much less profitable than an entirely different crop sequence, which would not include juar. Comparisons have been made in most cases between yields of small grains following and yields of those crops following maize, though other crops have been used as tests and comparison crops.

"Injury of juar to succeeding crops"

Ten Eyck and Shoe-Smith conducted crop sequence studies with maize and various other crops from 1904-1906. They secured the lowest yields of maize where this crop followed juar.

Towle secured a slight depression in the yield of wheat, following juar but apparently no depression in oats.

From 1909-1923. Brandon secured smaller yields of oats following juar than from oats following maize.

From 1916-1920 Cole and Hallsted carried on two year rotations in which maize and juar were alternated with wheat. In one of the maize rotations, the maize was spaced normally, while in the other the rows were spaced twice as far apart. The same variation in spacing was carried on with the juar rotation. Wheat following juar in both spacings yielded on the average less than wheat following maize.

Vinall and Gretty state that according to experiments conducted by them, maize, oats, and wheat gave lower yields after juar than after maize.

Sewell found that juar removed more fertilizing elements from the soil than did maize, but not enough to lead him to think that this was the cause of the depression. In testing out the other theory he (Sewell) found that leachings from pots growing juar if not aerated, inhibited the growth of wheat in pots watered with the leachings more than did similar leaching from pots growing maize.

Breazeale found very little if any evidence that the juar plant can absorb more nutrients from culture solution than can maize. He grew wheat in tap water cultures in which stubble of juar, maize, and cowpeas were added. In general the wheat plants in the juar stubble culture yellowed for a few days and then resumed normal growth, while the cowpea stubble culture had no set back. If the culture were made up and allowed to ferment for a month before starting wheat plants, there was no injury to those growing in the juar cultures. From these and similar tests he was led to conclude that "The results of these experiments indicate, first, that the injurious after-effects of juar are due to the presence of a toxic body, formed during the decomposition stubble; and second, that this toxic body is shortly volatilized or decomposed".

An observed phenomenon throws some additional light on the subject. When wheat or barley is planted following juar sometimes a markedly good spot about one foot in diameter in otherwise poor growth is noticeable. In such spots the growth is deep green, tall, and the plants stool profusely, while the plants outside of these spots are yellowish green, with one to three tillers per plant, and stunted. The outlines of such spots are abrupt. The spots are evidently due to stimulation and growth resulting from the droppings of the animals preparing the land for wheat and barley crop; there is usually a good stand of juar on these spots before the wheat and barley crops are planted, hence the wheat or barley could not make such good growth, under ordinary soil condition. Besides the outlines of the spots are generally too well defined and abrupt. If the assumption that the spot was good because of animal manure is correct, "the toxic body" hypothesis of Breazeale could not be used to explain this condition unless the manure can be said to have destroyed the toxic body. Upon a more critical examination of the experiments of Breazeale, his results can be explained or even predicted on the basis of current soil theory if one assumption is made, namely, that the stubble of the juar contains more sugars than does that of maize, cowpeas or peanuts. This assumption appears reasonable since some of the juars at any rate have a relatively high amount of sugar in the stalk as they approach maturity. Sweet juars are used for making syrup. Very little if any syrup is so made from maize stalks, so called "corn syrup" being secured from the starch of the grain by hydrolysis.

The working hypothesis for the explanation of the injury of juar to crops following then becomes as follows; the sugars of the juars diffuse into the soil solution after the plant has been killed and the soil wetted. The micro-organisms use these sugars as a source of energy and probably multiply rapidly. In

so doing they need nitrogen as a material for the protoplasm of the new organisms and take it, in the form of nitrate or ammonia, from the soil solution. After the sugars and their derivatives have been completely oxidised to CO_2, it would be expected that the normal nitrification processes would again be active and that the bodies of the micro-organisms which had used up the nitrates would be broken down to give nitrates again. The oxidation of sugars would bring about a toxic condition in the soil due, not to the presence of a "toxic body", but rather to the low available supply or absence of one or more essential elements.

Sugar in juar roots :—If some of the brace roots of juar, maize, and *bajra* are taken from plants in the field and tasted, it will be found that there is much more sugar in the juar roots than in those of maize and *bajra*.

Sugar Analysis of roots of some sorghum and maize.

	Glucose	Sucrose
Kafir	2·400	11·42
White durra	5·02	7·34
Fargo milo	10·81	4 95
Double dwarf milo	10·51	0·31
Honey sorghum	3·37	9·20
Broom corn	2·73	5·14
Sudan grass	8·10	8·28
Maize (King Phillap)	0·61	0 49

Percentages on basis of dry matter.

It will be readily seen from this table that the maize variety analysed is much below the varieties of sorghum in amount of sugar. From these figures, and taking into consideration the weight of roots found, the estimated amount of sugar present in the surface foot of soil on one acre would be approximately 550 lbs. after honey sorghum and 35 lbs. after maize.

Sugars sorghums : THE SOURCE OF THE INJURY.

There is abundant evidence of the action of sugars and other carbohydrates in not only diminishing the rate of ammonification in soils but in decreasing the amount of nitrates and ammonia already present in the soil as well.

Breazeals found that the injury to wheat seedlings grown in tap water cultures occurred when the seedlings were grown immediately after the sorghum stubble was added to water ; but, if decomposition was allowed to proceed for about a month before

planting the wheat, no injury was noted. When the decomposition of the roots was allowed to take place near a furnace, the decomposition was completed and a good nutrient solution produced in less time.

Hawkins observed that the injurious effect of sorghum on succeeding crops disappears in a few months after harvest.

Cole and Halstead reported from field tests that spring sown barley following kafir did nearly as well as that sown after maize but that winter wheat sown in the fall immediately after the harvest of maize and kafir was reduced in yield because of following kafir.

Hutchinson observed in his experiments at Rothamsted relative to the effect of carbohydrates on nitrogen fixation that conditions adverse to plant growth were brought about soon after the application of carbohydrates to the soil. This was observed not only in the early stage of the pot experiment, but to a greater degree in the field where starch and sugar were applied to different plots. The injury was greatest where the crop was sown soon after the carbohydrates were applied. Counts of bacteria run in conjunction with his experiments showed very marked increases of the bacterial flora following applications of sugar and starch. Chemical tests showed a marked decrease in the amount of nitrates and ammonia in the soil in the few days following applications of starch and sugar. From these observations, he concluded that the number of bacteria increased at the expense of readily available nitrogen in the soil.

Molasses has been used in the fertilization of cane fields in Java and in the Mauritius islands.

Peck secured harmful effects by applying molasses frequently to the growing canes, though beneficial results were obtained by the application of molasses some weeks in advance of the planting of the canes.

Conclusions :—(1) Observations by many experimenters and farmers have disclosed that maize is much less injurious to the succeeding crop than is juar.

(2) The presence of a markedly good spot in the small grain crop following sorghum caused evidently by droppings from the animals preparing the seed bed cannot be adequately explained by the toxic body theory as the cause of the injury of juar to succeeding crops.

(3) The observations on sorgham injury to following crops can be explained on the assumption that juar roots are relatively higher in sugars than other allied crops.

(4) The assumption is verified by the analysis of the roots of sorghums and maize.

(5) The literature shows that the injurious after-effects of juar on succeeding crops largely disappear after a few months.

(6) Data shows that the injury from application of carbohydrates disappears after a time and that the injury is due to the competition for plant food elements in the soil between the micro-organisms on the one hand, and the higher plants, on the other with resulting injury to the higher plants. In most cases this competition first depletes the supply of available nitrogen.

(7) Analysis of soil to which varying amounts of dried roots had been added showed that juar root decay depresses nirification and at first lowers the amount below that present in the soil at the start.

(8) With the cause of juar injury to following crops explainable as due to the competition between micro-organisms and the crops for available plant food resulting in one or more elements becoming limiting factors for plant growth, remedies can be suggested.

(9) As sugars and possibly other carbohydrates are the primary source of the injury, every means should be used to reduce to a minimum the amount of sugar entering the soil. Means of doing this would include pasturage or removal of stalks and stubble, growing the juar in thinner stands, and planting varieties whose roots develop only a low percentage of sugar.

(10) By inducing juar roots and stubble to decompose rapidly it may be possible to have the injurious period over before time to plant the following crops. This is probably best accomplished by ploughing to kill the plants of juar immediately after harvest and then irrigating.

(11) In most cases competition between micro-organisms and the crops following juar will deplete the available nitrogen supply first. Limited tests have shown marked response of barley and wheat suffering from injury caused by following a juar crop. Therefore these should not be planted too soon after juar.

(12) Naturally inoculated legumes have apparently made nearly as good if not as good growth, following juar as following some other crop. This is most probably due to the fact that leguminous plants are able to fix atmospheric nitrogen and therefore are not entirely dependent on soil nitrogen as are other plants.

The yield of rice per acre :—

In Spain	... 5,700 lbs.
„ Italy	.. 3,300 „
„ Japan	.. 2,100 „
„ India	.. 890 „

ALKALI SOILS

S. C. Chowdhury, B. Sc. (Ag.).

On large tracts of land in many portions of the earth's surface the quantity of soluble salts in the surface soil is so considerable as to greatly hinder, or frequently prevent, the use of the land for agricultural purposes. These alkali soils occur to a large extent in Northern Africa, in Northern India, in Australia, and in the western parts of North and South America. In Europe they are found to a more limited extent in Hungary, Austria, Italy, and France.

In India there are thousands of acres of alkali land. They are in many places absolutely devoid of all vegetation. In accordance with the recommendations of the Committee of 1903, a careful survey of the lands affected by salt was made in the Nira Valley by the Survey Department in 1907, with the result that an area of 4,870 acres was found to be damaged to such an extent that ordinary crops could not be grown. Similar soil surveys have been made in the Punjab, the United Provinces of Agra and Oudh, the Central Provinces, Rajputana, and Bombay and it has been found that there are many thousands of acres of land in these provinces that are entirely unfit for agricultural purposes, due to a deposit of salts in the surface soil.

But the area of alkali land in India would not perhaps have the importance which it really possesses if the area of land affected with salt were not increasing. There is the universal testimony of the cultivators that the extent of alkali land is rapidly increasing in all localities. Moreover investigations in alkali land by the different Provincial Governments show that the alkali menace is increasing fairly rapidly. The alkali land surveys made in 1904 and 1907 in the Nira valley, covering twenty-one average sized villages, show that there has been an increase of 835 acres of alkali land in three years, or over 20 per cent of the previously existing area.

As the area of barren land owing to salt in India is increasing and increasing fairly rapidly, and the evil is likely to become greater in the future, it becomes important to ascertain the source of the salt, its precise effect on the soil and on the vegitation, and the methods that can be adopted first for checking its spread and then for bringing back the barren areas into cultivation.

Alkali Soils :—Alkali soils are so called when they contain a greater or less amount of water soluble mineral salts sufficiently concentrated to injure plants, whether or not the salts have a basic chemical reaction.

Alkaline and Alkali Soils:—True alkalinity is to be distinguished from salinity. The latter condition which makes one call a soil alkali, is one in which neutral salts like sodium sulphate, sodium

carbonate, or sodium chloride are in solution and in high concentration, so that it interferes with the absorption of plant nutrients. True alkalinity obtains where hydrolizable salts give rise to a concentration of OH ions greater than in pure water. Pure water as H_2O or HOH dissociates to a slight extent into hydrogen ions ($H+$) and hydroxyl ions ($OH-$). The hydrogen ions are bitter and give rise to acids and soil acidity. Hydroxyl ions give rise to true soil alkalinity.

Origin of Salts in Alkali Soils:—All mineral soils are derived largely from the weathering of rocks. Stewart, Peterson, and Greaves have shown that there is an intimate relation between present-day alkali accumulations and the alkali contents of the rocks from which certain soils were formed. From extensive studies of the geological formations in Utah, Colorado, Arizona, Wyoming, Idaho and Nevada, these investigators found that wherever alkali is formed and found in very large amounts it apparently originated from materials deposited from concentrated salt waters of some ancient sea in an arid climate.

The origin of sodium carbonate is in some cases due to the weathering of mineral silicates, as for example soda felspar in the soil. Hilgard, however, believes that its most usual source is to be traced to a reaction between sodium sulphate and calcium or magnesium carbonates in the soil.

The origin of sulphates is attributed to the oxidation of pyrites or by some agronomists to the occurrence of gypsum in the original rock. The possible accumulation of the sulphates supplied by rain-water does not seem to have been considered.

How lands become Alkali:—Alkali soils are usually characteristic of arid regions. They may occur naturally or as the result of irrigation. We know soils are formed largely of disintegrated rocks. This rock contains many soluble materials. If the region is humid, these soluble materials are carried off gradually in the drainage waters. They find a resting place in bodies of water that have no outlet, as in the ocean, the Dead Sea, the Sambar Lake, and these waters become salt. When the region is arid, there is likely to be no drainage and the little water of rainfall is lost through evaporation and the soluble materials are left at the surface. If irrigation is practiced, more of the materials are taken into solution, more water is evaporated from the surface and more of the salts are accumulated on the surface.

Composition of Alkali Soils:—The soluble salts occurring in alkali soils are numerous. Carbonates, sulphates and chlorides of sodium, potassium, calcium and magnesium occur in the largest amounts. Sodium may be present as carbonate, sulphate, chloride, phosphate and nitrate. Potassium may be similarly combined.

Magnesium is likely to appear as a sulphate or a chloride and calcium as a sulphate, a chloride, or a carbonate. One salt will predominate in some soils, and other salts in other soils. The following tables give the composition of the soluble salts from a number of alkali soils.

Table I.

Composition of some typical Alkali Salts. (Hilgard).

	Kern Co. California.	Meagher Co. Montana.	Kittitas Co. Washington.	Tulare Co. California.
Potash ..	5·14	1·18	9·58	1·76
Soda ..	36·99	39·56	45·59	38·39
Lime ..	0·15	2.86	0·03	..
Magnesia ..	0·23	1·31	0·07	..
Ferric Oxide and Alumina ..	0·30	..	0·04	..
Sulphuric Acid ..	51·23	34·97	0·09	13·20
Chlorine ..	0·29	15·40	0·99	7·40
Carbonic Acid ..	0·23	1·19	34·93	11·62
Nitric Acid ..	..	5·37	..	10·50
Phosphoric Acid ..	0·09	..	1·05	1·05
Silica ..	1·34	0·05	0·82	..
Organic Matter ..	4·07	1·29	7·03	17·32

Table II.

Composition of Alkali Salts, India. (V. A. Jamhane).

	White Alkali at Sarhari Sample No. 111.	Black Alkali at Sukkur Sample No. 45.	Black Alkali at Nawabshah Sample No. 99.
Ca. Carbonate ..	0·13	0·19	0·39
" Sulphate ..	5·73	14·15	9·78
" Chloride ..	..	10·66	22·46
Mg. Carbonate ..	..	..	..
" Sulphate ..	1·13	..	..
" Chloride ..	..	..	21·14
Na. Carbonate ..	0·05	14·21	0 13
" Sulphate ..	9·12	..	..
" Chloride ..	83·84	60·79	46·10

White and Black Alkali :—The chlorides, sulphates, carbonates and nitrates of sodium, potassium and magnesium and the chlorides and nitrates of calcium, are commonly included as alkalis in the soil. The sulphates and chlorides of sodium, potassium, calcium and magnesium, when concentrated on the surface of the soil, produce a white incrustation which is very common in alkali regions during the dry seasons due to evaporation of soil moisture. Incrustations of this character are called white alkali.

The carbonates of the alkalis, particularly sodium carbonate dissolve organic matter form the soil, thus giving a dark colour to the soil solution and to the incrustation. For this reason alkali containing large quantities of these salts is called black alkali. Black or brown alkali may also be produced by calcium chloride or an excess of sodium nitrate.

Black alkali is much more destructive to vegetation and soil than is white alkali. A quantity of white alkali that would not seriously interfere with the growth of most crops will completely prevent the development of useful plants if the alkali is black.

Movement of Salts in Soils :—If it were possible to maintain a moisture distribution in irrigated soils such that moisture movement would be continuously downward, there would be relatively little trouble from alkali on irrigated areas. A continuous downward movement of water would gradually decrease the quantities of soluble salts in the surface soil from which plants obtain most of their moisture and food. However, in the absence of adequate under-drainage, percolating waters from either adjacent or distant lands soon fill the lower soil spaces and cause the water-table to rise. During periods between irrigations a high water-table favours the upward movement of water to the land surface where it evaporates. The soluble salts carried by the upward moving water cannot evaporate and hence they are deposited on or near the soil surface.

The extent to which salts move with water passing through a soil has been studied by a number of investigators. In laboratory experiments, with alkali soils kept continuously so moist that there was constant water movement, Harris has shown that alkali, principally sodium chloride, is very rapidly transported from one part of the soil to another either upward or horizontally. The salts became very concentrated in the upper inch or two of the soil where the water was allowed to evaporate. Tulaykov found salts moved gradually and more or less completely to the surface of a column of soil 150 cm. in height supplied with water at the bottom. Hilgard as well as Puchner and others has noted a migration of salts upward and downward as the moisture changed places.

Puchner using quartz sand loam and rich humus soils found the movement to depend somewhat on the physical and chemical properties of the soils. Powdery soils allowed the salts to move more readily than crumbly soils. Kossorich reports a greater movement on a less clayey soil than on a sandy soil and that sodium chloride hastened the rise of water while sodium carbonate impeded it. It is probable that the differences both in the nature of the salts and in their concentration so often noticed in fields containing alkali are, in part at least, due to changes in the nature of the soils which in turn modify the rate of capillary action. In studies of the movement of moisture, Briggs and Lapham conclude that "concentrated or saturated solutions of all salts materially diminish capillary action" but that in dilute solutions the neutral salts had very little influence on capillary action. They found sodium carbonate to have a greater influence on capillary movement than the neutral salts.

The extent of the fluctuation of salts upward and downward in the field has not been determined with any degree of accuracy. Hilgard considered the movement to be mostly in the top 4 ft. Considering the ease with which the salts move with the water and from observations of the movement of soluble salts with water when no alkali was present, it is very probable that the salts are frequently moved to great depths where not prevented by impervious soils or by a water-table. Investigations show that water is seldom drawn to the surface by capillary action from a depth greater than 2 or 3 ft. so that the greater part of the alkali which penetrates beyond this depth never again reappears at the surface unless the water-table rises to within a few feet of the surface. Water movement below the top 2 or 3 ft. is probably caused by moisture removed by the plants or by the action of gravity so that it is improbable that there is such movement of salts other than local diffusion and movement with the gravitational water.

Alkali salts confined only to the surface:—The alkali salts are generally confined to a few feet of the soil. This fact appears in the numerous examinations of alkali land to the depth of 4 ft. made in California, and further evidence on the subject is supplied by the purity of the water in the deeper wells sunk in the same district. We have thus to deal with a limited quantity of alkali salts, and the first and great lesson we have to learn is that the injurious effect of these salts depends entirely on their position in the soil.

Table III.

Pounds of Alkali Salts per acre at various depths, Tulare, California. (Hilgard).

	Natural soil, unirrigated.		Bare land, irrigated 4 years.
	May 3, 1895.	September, 1895.	May, 1895.
0″ to 3″	220	260	7,730
3″ to 6″	130	160	4,490
6″ to 9″	220	200	4,360
9″ to 12″	240	240	3,180
12″ to 15″	350	540	3,320
15″ to 18″	950	1,170	2,860
18″ to 21″	1,690	1,970	2,230
21″ to 24″	1,470	2,480	1,090
24″ to 27″	2,620	3,200	800
27″ to 30″	4,910	4,610	580
30″ to 33″	5,290	5,120	400
33″ to 36″	4,260	3,000	360
36″ to 39″	2,240	1,100	340
39″ to 42″	1,140	680	190
42″ to 45″	810	450	230
45″ to 48″	490	240	270

Alkali and Texture of the Soil :—Texture of the soil has considerable influence on the production of alkali land. In a coarse-grained soil, having little power of retaining water, a considerable amount of percolation may occur even with a small rainfall; in such a soil there will also be little return of saline solutions to the surface by capillary action. In a soil composed of fine particles both the conditions are reversed. Percolation is here diminished, the rise of the salt solutions to the surface by capillary action in dry weather also becomes more considerable; the conditions are thus far more favourable for the accumulation of saline matter in the surface soil.

Alkali and Climate :—Soils in arid regions contain relatively large quantities of soluble salts. A heavy annual rainfall, such as occurs on the soils of humid regions, causes water to percolate through the soils and carry to the streams, rivers and oceans large amounts of soluble mineral substances. On the other hand, the scanty rains of arid regions do not penetrate the virgin arid soils deeply enough to cause appreciable percolation. The greatest depth of penetration (of the water from natural precipitation) is found to vary from 1 to 4 ft. depending on the amount and time of precipita-

tion and the nature of the soil. The lack of percolation through arid region soils, together with the excessive evaporation of water in arid regions, gives rise to the accumulation of large quantities of soluble salts that are injurious to plant life.

Alkali and Rainfall :—The limits of rainfall within which alkali lands are found vary with other associated conditions. In the great California Valley with a rainfall varying in different parts between 6 and 34, inches, alkali lands are met with only where the rainfall is below 20 inches. In the United Provinces of India, alkali lands are found with a rainfall as high as 24 to 28 inches. The rain in these two localities is, however, very differently distributed. In California the rain nearly all occurs between November and April; it falls thus in the cooler portion of the year when least is lost by evaporation; its whole effect is also concentrated into a few months. Under these circumstances the rain produces the greatest amount of percolation through the soil which is possible under the circumstances. In India, on the other hand, half the rain falls as a torrent in July and August, the greater part of which runs off the surface instead of penetrating the soil, while the remainder of the rainfall is distributed throughout the rest of the year. The same amount of rain thus produces a smaller amount of percolation in India than in California.

Alkali and Irrigation.—In irrigated regions, the injurious effect of alkali is in many cases discovered only after irrigation has been practiced for a few years. This is due to what is known as a "rise of alkali"; and comes about through the accumulation near the surface of the soil of salts that were formerly distributed throughout, perhaps at a depth of many feet. Before the land was irrigated the rainfall penetrated only a little way into the soil and when evaporation took place salts were drawn to the surface from only a small volume of soil. When, however, irrigation water is turned on the land the soil becomes wet to a depth of perhaps 15 or 20 feet. During the portion of the year in which the soil is allowed to dry, large quantities of salts are carried towards the surface by the upward moving capillary water. Although these salts are in part carried down again by the next irrigation, the upward movement constantly exceeds the downward one. This is because the descending water passes largely through the non-capillary interstitial spaces, while the ascending water rises entirely through the capillary spaces. The smaller capillary spaces, therefore, contain considerable quantities of alkali salts—the volume of water carrying the salts downward in the capillary spaces is less than that carrying them upward through these spaces. Considerable quantities of soluble salts, therefore, accumulate at the surface after some time.

There are large areas of land in Egypt, in India and even in France, Hungary, Austria and Italy, as well as in America that have suffered in this way, and not infrequently they have reverted to a desert state.

Alkali and Water-Table.—The nearer the water-table is to the soil surface, the greater is the driving force tending to cause water to rise upward from the ground water to the surface. A high water-table decreases the resistance to capillarity owing to the fact that it maintains a relatively high average percentage of moisture in the soil above the water surface. The soluble salts dissolved by downward percolating waters are held near the surface of the body of ground water, where they may readily be drawn by capillarity back to the soil surface and there be deposited as evaporation occurs.

Headen made a rather detailed study of the effect of seasonal movement of water-tables from which he concluded that as the water fell much of the salts in the free water was retained by the soil so that the free water gradually became weaker as it sank, and again increased as it rose. He found that the kind and quantity of salts in the soil solution differed markedly from those found in the free ground water or from the alkali incrustations on top of alkali soil. Certain of the soluble salts were absorbed by the soil, while others moved somewhat more freely.

Irrigation farmers sometimes urge the advantages of keeping the water-table within a few feet of the soil surface, because of the high crop yields obtained during the early years after it has risen from the great depths. The favourable moisture supply from a water-table a few feet below the soil surface does frequently cause high crop yields, but as a rule, in areas where alkali salts occur the temporary favourable condition of the high water-table is followed by serious decrease in yields, if not by complete non-productivity due to alkali concentration. The need for careful and conservative use of water in order to delay as far as possible the time of the rise of the water-table and also the need for providing artificial drainage of areas for which present drainage is inadequate to keep the water-table below the soil surface, is not likely to be over-emphasized.

High-yielding varieties of flax (linseed) from India are being successfully grown in the Imperial Valley of California.

According to the latest returns, the cattle population in British India alone is 151,339,000; sheep and goats amount to 61,944,000; and the remainder, consisting of horses and ponies, mules, donkeys and camels total 3,777,000.

KEEPING MILK GOATS IN INDIA

By J. L. Goheen, B. A.

Chapter IV.

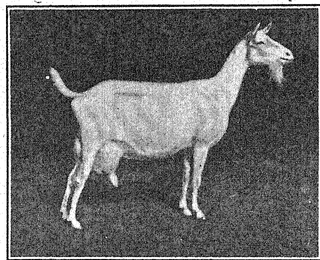
Housing

The subject of providing living quarters for goats need not be a very serious one, in a warm tropical country like India. Two or three points need to be kept in mind: first that shelter is required against excessive heat and inclement weather; next, protection from thieves and predatory animals, like the wolf, is essential; and third, there should be freedom from all kinds of vermin and pests that give so much trouble to goats. In short, furnish your goats with a place where they may be dry and comfortable, safe and secure, and free from vermin, and you will have done for them all that they require in the way of housing.

A wide-spreading shady tree may be sufficient in the way of housing arrangements, where the climate is dry and mild, and where there is no danger of loss from thieves or animals. Such an arrangement will cost nothing, and if kept clean and dry, ought to be satisfactory under the conditions mentioned. However, if one also keeps a male goat it will be necessary to have a separate spreading tree for him, because it has already been carefully explained that the male should always be kept separate from the females. Let him also have his nice spreading tree, and make all conveniences for his feeding there just as satisfactory as they have been made for the other goats, and the chances are that all will go on very nicely. The little kids can be kept under the large inverted type of basket that shepherds use for keeping the new-born lambs, and they will get on very happily in that until they are old enough to run along with their mother.

Probably most of the sheep and goats in India today are kept under some conditions as described above, except that there is no segregation of the males from the females. No doubt a good many of them have even more covering over their heads in the form of a thatched roof, or something like that, and that is an important point, for goats should always be protected from dampness. It is true that they may get wet when out grazing in the rain, but their quarters should be located in a place where there is good drainage—a place that is high and dry. Dampness in the living quarters brings on colds and these may later on develop into pneumonia, one of the few diseases to which goats are quite susceptible. It is very important, then, that the floors, especially, but also the sides or walls of the quarters, be kept as free from dampness as possible.

If weather conditions are not favourable, or if there are nearby jungles where wolves or panthers are likely to exist, then it is highly desirable that there be strong and well-built quarters for the goats, otherwise one may suffer no small amount of loss. The shed or building required need not cost a great deal of money but one should spend a good deal of thought as to its construction. It should have sufficient room in it for the goats one intends to house there; there should be proper arrangements for feeding, and possibly for the storing of feed, unless one intends to store it elsewhere; as stated above dampness must be kept out, also all other enemies; there should be good arrangements for draining out the urine, so that it may collect outside; and if one intends to keep a male goat for breeding he should have either quite a separate compartment well shut off from the other goats, or else a special shed of his own. All this, then, requires careful planning.



I-Iraqi Doe. A-Short ears characteristic

The size of the building will naturally depend chiefly upon the number of goats one intends to keep in it. Roughly speaking, about 10 to 12 square feet are required per animal (say a space 4′ by $2\frac{1}{2}'$ or 3′ in size), this not including the space in front of each animal for the manger but simply enough space for the body of the goat itself. The manger should not be less than 15″ wide, and each goat should be allotted as much space in it as is allotted for the width of body, *viz.*, $2\frac{1}{2}'$ or 3′. If there are a good many goats to be kept it will be well to plan for the gable-roof type of building. It should be made wide enough for two lines of goats, facing each other, with the manger in between the lines. This should mean that it would be not less than 10′ wide, and if it were made 12′ that would be better. The length would depend on the total number one intended to keep. The height of the roof should be at least enough to permit one to walk about erect without danger of hitting one's head. Care should be taken to see that there are no leaks in the roof, also that the slope is sufficient to drain the water off rapidly.

It would be well to raise the floor of this building at least 6″ above the level of the ground outside. In addition to that the

floor itself should have a decided slope downwards from the manger to the sides of the building, there being a drop of at least 3" from the manger to the edge of the space allotted for the goat. That would mean that the manger should be not less than 9" higher than the level of the ground outside. This floor should be made of earth well stamped down so that it will not give way to the stamping of the goats as they stand in their individual stalls. All around the inside edge of the building there should be a good drain leading to a pit outside where the manure and urine are to be stored. This drain or gutter should be well made so that the urine does not sink into the ground within the building but does actually flow out to this pit.

Materials to be used for this building may be such as suit the conditions of any given locality. It will be advisable to have walls constructed on that side or those sides from which the prevailing rain and winds come. The other side or sides may be enclosed with some strong kind of wire fencing or some other light and suitable material such as will insure good ventilation. There probably need be only one door to the building and it may be located in the most convenient place, while windows may or may not be constructed according to the conditions of the particular spot. It will be advisable, however, to allow sunshine to enter the house, particularly in the mornings, and as stated above, it is very necessary that there be good ventilation. If the building is made secure so that thieves or predatory animals can not enter, and vermin has little or no chance to hide, one may feel quite well satisfied with the building. It may have cost little or much, but it should have in it the requirements and specifications, simple as they are, mentioned above.

It will be far better to have the male goat housed in an entirely different building, and one that is located about 50' at least distant from the other goats. He is to be kept there off by himself, consequently he should have quite a good deal more space then was intended for the females in their home. His house may be the shed-type roof, (roof sloping one way) for this will be cheaper to build. It should be at least 8' wide and as many feet long for he should be allowed to have a fair amount of freedom in this house. Furthermore, at breeding time, the females should be always brought to him. The floor should be raised, as stated above, and there shouid be good ventilation, also chance for the sun to shine in each day. The manger may be built along one side of the house. It will be well if this shed is so placed that the male goat will not have occasion to see the other goats—at least he should not see them frequently because that will cause him to become unduly restless. He will be much happier and keep in better condition if he lives his own quiet life.

There should be an enclosed run adjoining the main house where the young kids may be let out each day for play and exercise. This run normally should be longer than it is wide, and it should be so constructed that the kids may be perfectly safe from outside enemies, while they themselves must not be allowed to get outside. If some large rocks are available, or failing them, some stumps of trees or similar objects, these may be kept in the middle of the run so that the kids may climb or jump upon them. They delight in such play and it is excellent for them. It would be well also to have several trees inside or near this run so that there be good shade for the kids. They should not be exposed to the hot sun during the noon hours of the day.

The male goat ought to be provided with a run in a similar manner, and in it there also ought to be some objects on to which he can climb or jump. This is especially important because ordinarily he will not be allowed out to graze, unless he should be taken to some separate spot and tethered there. It is quite all right to do that provided one is careful to see that he is securely tied, also that he has shade for the noon hour. In any case, however, it is advisable that he have his own run.

Goat manure is very valuable and one will find that there will be good demand for it, if indeed one is able to spare it. Hence it should be carefully stored. For this purpose a pit is necessary. This pit should be fairly deep, say not less than 3 feet, while it also ought to be 3 to 4 feet wide, and as long as the number of goats one keeps should indicate. The pit should be located rather close to the main house so that the urine may be drained into it. The goat droppings and sweepings from the stable should be thrown into this pit systematically. By that it is meant that one should begin to fill the pit from the end nearest the house, and see that a section there is filled up level with the surface of the ground when that section should be well covered over with the top soil from the pit, and a new section begun in similar manner. The sealing up of the pit this way means that no valuable gases are allowed to escape, also that the manure rots more quickly and its several ingredients become more easily available to the crops once it is taken out and put into the ground. Furthermore, by covering the manure there is far less danger of stable flies finding a nesting place. And it is important that these be kept from infesting the goat stable.

Points to be noted, then, in connection with housing may be summarized as follows :—

1. Where the climate is favourable, goats may be kept under wide shady trees, provided of course that there are no wolves or panthers about.

2. Good drainage is essential where the goats are kept, for dampness is a source of great danger to them. Cleanliness is most important also, and for this purpose the location of a manure pit near the stable, into which the urine may drain and all sweepings may be thrown is a very necessary part of the equipment.

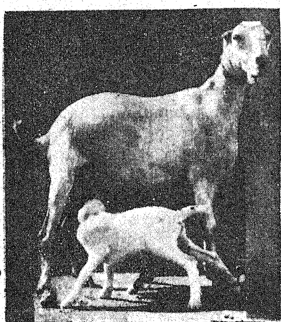
3. If for the sake of more security and protection a building is required, this building should be 10′ or 12′ wide with a manger of 15″ width running down the centre, the goats to be tied on either side, and 10 or 12 square feet allotted to each goat.

4. The roof of such a building should be gable-type high enough to insure plenty of space for the care-taker to move about freely. The walls should be so constructed on the sides from which rain or winds come as to keep out dampness and the floor should be raised at least 6″ to 9″ to insure good drainage. There ought to be good ventilation and it would be well to arrange so that the morning sun can shine into the house.

6. Runs should be provided for the kids and the male goats, each adjoining its own building, and supplied with some sort of objects upon which the animals may climb or jump. Good shade also is essential for these runs.

Special Notes.

1. In the main building, room should be set aside for female goats that have given birth or are about to give birth to kids. It would be well to have one or more special compartments separated off for this purpose, each to have sufficient space for some free movement for the mother goat and her kids. Such compartments might be 4′ by 5′ or 6′. There might be also kept one similar compartment for growing kids, it to be of similar size. Failing that kids could be kept under the inverted type of basket that shepherds use, during the night in some vacant corner, and turned loose in their run during the day-time.



Pure Swiss Goat.
Female of Saanen Breed.

2. An ideal stable would also allow for a special space in which the milking is to be done, say an earthen platform near the door and raised about one foot above the general level of the stable floor. This platform should be 4′ long and

(*Continued on page 49.*)

SOME DISEASES OF DOMESTICATED ANIMALS COMMUNICABLE TO HUMAN BEINGS

By S. C. Banerjee, G.B.V.C., Veterinary Surgeon,

Allahabad Agricultural Institute.

Many people are ignorant of the fact that amongst the numerous diseases that attack domesticated animals there are some which can also attack human beings. These diseases are mostly caused by micro-organisms and if somehow or other the causal organisms gain entrance into the human system they produce the specific disease. It is important, therefore, to have a knowledge of these diseases, and hence brief descriptions of them are given below:

1. *Anthrax.*—It is a rapidly fatal infective disease of the blood known from very early times and is caused by Bacillus Anthracis. It attacks all mammals including human beings. Sheep, cattle, camels and horses are susceptible in the order named. Carnivorous animals are highly resistant. Cold blooded animals are immune. The disease in animals is so very acute and runs so rapid a course that rarely any symptom is noticed during life and it is usual to find an animal lying dead. The usual manifestations previous to death are very high temperature, abdominal pain, cyanosis of the external mucous membranes, blood in the nostrils, feces and urine, convulsions and death. The carcase very rapidly decomposes and tarry black blood comes out of the nostrils and rectum. The diagnosis should be confirmed by postmortem and microscopic examinations. The mortality in this disease is eighty to one hundred percent. The mode of infection in animals is mainly by ingestion of food contaminated with bowel and other discharges of the diseased animals; flies and biting insects may also infect healthy animals. Men contract a cutaneous form of the disease—the "malignant pustule"—through contamination of open wounds and it is not uncommon that laboratory workers, butchers and slaughtermen get the disease by the handling of materials from infected carcases; cases are also on record where the infection occurred by using unsterilized and infected shaving brushes. The pulmonary form of the disease in man—the "woolsorters" disease with symtoms of septicaemic infection—is contracted by the inhalation of hair and wool from Anthrax carcases and the intestinal form of Anthrax is contracted by the ingestion of contaminated materials giving rise to fever, vomiting, pain, dyspnoea and cyanosis.

The blood of an Anthrax carcase abounds plentifully in the causal organisms. When these organisms come out along with spilt blood and get in contact with air they form highly resistant

spores and have been known to remain alive and infective for a period of about thirteen years. While taking preventive measures for the spread of the disease this point should be remembered and the carcase should be burnt or buried unopened with lime at least six feet under the ground. The postmortem should be done in an out-of-the-way place not frequented by either men or animals. Shaving brushes which do not come from a reliable source should be looked upon with suspicion and should be sterilized by soaking at a temperature of 110° for four hours in a 10 per cent solution of formalin before being used.

2. *Glanders-Farcy.*—It is a highly contagious disease of the lymphatic system mainly of the equines and is caused by *bacillus mallei*. When the disease manifests itself in the respiratory passages it is customary to call it glanders and when the lymphatics of the skin are affected it is termed farcy. Both forms of the disease may occur simultaneously in one and the same case. Cattle and chickens are immune to this disease. Goats, sheep, cats and dogs have contracted the disease but occurrence in them is uncommon. Animals may get the infection through inoculation, inhalation or ingestion. The symptoms in the glanders form are a glairy sticky discharge from one or both nostrils, ulceration on the nasal mucous membranes, swelling and hardness of the submaxillary lymphatic gland and a variable amount of fever; the animal looks unthrifty and has an abnormally large appetite; often there is a short, hollow cough and a simple punch on the ribs makes the animal grunt indicating that the lungs are affected.

In the farcy form there is usually swelling of one or another of the limbs. The lymphatic vessels swell up with nodules or "buds" and ulcerations along their course. These ulcerations do not show any tendency to heal, and discharge an ichorous yellow pus. For definite diagnosis all doubtful animals should be tested with mallein.

Men contract the disease by contamination of cuts, scratches and abrasions, and hence should be careful in handling diseased animals at postmortems and in laboratory experiments.

The *bacillus mallei* is easily destroyed by a temperature of 131°F in ten minutes, or of 212°F in two minutes. A one percent potassium permanganate solution or a five per cent carbolic acid solution soon destroys it.

As the disease is highly infective and dangerous to men, neither the maintenance nor the treatment of the diseased animals is advisable, and whenever one is sure that an animal is suffering from glanders it should be destroyed.

3. *Rabies*:—It is one of the world-wide and oldest known diseases. It is an acute, specific inoculable disease affecting prin-

cipally the nervous system. All warm-blooded animals are susceptible to it. It is essentially a disease of the carnivorous animals—human beings and other animals being affected only as the result of bites of these animals. The specific organism causing the disease is deemed to be an ultramicroscopic one and exists in the brain, medulla, cord, peripheral nerves and saliva of the dead or diseased animals and men. It has been proved that the virus is present in the saliva up to eight days before clinical symptoms are developed. Once the symptoms have set in, the animal never lives longer than ten days.

In dogs and in other animals two types of this disease are met with: (1) The furious form and (2) Dumb or paralytic form. The former is more common in dogs but each form may turn into the other. The premonitory symptoms in both these forms of the disease are the same. The first noticeable symptom is a marked change in the disposition of the dog, there being a tendency to hide away in corners and under beds. In other cases the animal becomes more affectionate and desires to lick the hands of the owner. Following this stage come the symptoms of nervous excitability manifested by restlessness, constant getting up and lying down, the least sound making the animal start up violently. It will bite a stick if held before it and will try to catch imaginary objects. The barking changes into a peculiar vacant drawling howl which is diagnostic of the disease. Then the more violent symptoms develop; the animal rushes about each and every object it finds in its way. Salivation is very profuse and the saliva hangs like strings from the mouth. Rabid dogs when they get loose have a special tendency to bite other dogs and run aimlessly a great distance. Paralysis, however, soon sets in, first starting on the hind legs, then becoming general.

In the dumb form of the rabies a paralysis of the muscles of the jaw takes place, which causes the lower jaw to hang and drop down and the saliva to dribble from the mouth. This form of the disease is frequently mistaken for the dog having a bone in the throat, but in the latter case the animal will constantly try to dislodge the bone by its front feet; in rabies this does not occur.

Like men, rabid dogs do not suffer from hydrophobia. Treatment of any sort is useless when once the symptoms of rabies have developed both in dogs and human beings.

The period of incubation of the disease is extremely variable and depends upon: (1) The site of the wound, (2) The relation of the nerve, and (3) the amount of virulence of the virus. Generally it may be told that the deeper the wound and the nearer it is to the brain the shorter is the incubation period. The average incubation period is as follows:

Man—forty days ; Dogs—twenty-one to forty days.

To control the spread of the disease in dogs the following measures may be taken if possible : (*a*) destruction of all ownerless dogs, (*b*) owners held legally responsible for damages inflicted by their dogs, (*c*) compulsory notification of all cases of suspected rabies and (*d*) muzzling and quarantine of dogs.

References :—Diseases of Animals in Tropical Countries, Edmonds and Walker.

A Treatise on Hygiene and Public Health, B. N. Ghosh.

Hand book of Contagious and Infectious Diseases in Animals, Army Headquarters.

(*Continued from page 45*)

$2\frac{1}{2}'$ wide, and there should be a small manger at the head end where the goat may be tied and fed while the milk is being drawn. A low table or long stool of similar dimensions would probably be just as serviceable as the permanent earthern platform.

3. As has already been pointed out it is most important that the mangers be kept clean and that there be no place for vermin to hide anywhere in or about them. The walls should be high enough to keep the goats from stepping into the feeding place, while the tying arrangement should consist of a swivel ring fastened to the ground on the outside where the wall joins the floor. Only enough rope should be given to permit of the goat getting her head well down into the manger.

A cure for Prussic Acid poisoning :—An effective cure for prussic acid poisoning in livestock has been discovered by veterinary scientists of the United States Department of Agriculture. Sodium thiosulphate alone, or in combination with sodium nitrate, if administered in time will save the lives of animals poisoned by eating plants which for some reason or another have developed prussic acid or hydrocyanic acid. Prussic acid does not develop in dangerous quantities in healthy growing plants, but does develop on the valuable forage crops when the normal growth has been retarded or stopped by drought, frost, wilting, mowing or other causes. It is found to be most prevalent in the sorghums (juar), johnson grass (baru), arrow grass, sudan grass, flax, wild black cherry and wild chokeberry. Treatment should be given by a skilled veterinarian and the Bureau of Animal Industry in informing the profession as to the results of its experimental work and proper means of administration.—*Pacific Rural Press.* (*U.S.A.*)

FIFTH ANNUAL FARMERS' FAIR

ALLAHABAD AGRICULTURAL INSTITUTE.

The fifth annual Farmers' Fair of the Allahabad Agricultural Institute will be held as usual early in March, 1935. The date has tentatively been set for March 4 to 7 inclusive and these dates will probably be adhered to though it is possible that they will be changed 2 or 3 days earlier.

The Fair will follow the same general lines as in previous years. There will be exhibits of implements, crops and processes in all phases of agriculture. Prizes will be offered as usual for the best examples of various crops, field, vegetable and fruit. There will be a ploughing contest as was held last year, the prizes being Wah-Wah ploughs. There will be exhibits of Women's handicrafts, posters on health and hygiene topics, exhibits of dairy products, fruit and jams.

In addition to the special exhibits, the different lines of work ordinarily carried on by the Institute will be open to inspection. The cross-bred cattle, Napier and Guinea grasses and other special lines of work will be open to study.

In line with its usual practice of showing for the first time any new development perfected during the year at the Fair, the Institute will show for the first time this year a new plough developed especially for ploughing hard dry ground. It has been tested for two seasons and has proved highly successful. Both bullock and tractor models will be shown. A tractor mounted on pneumatic rubber tyres will also be a feature of interest to many.

The Fair is open to the public. No admission is charged and wherever possible, accommodation will be arranged for out of town visitors. Demonstrations will be held in the daytime and popular meetings in the evenings.

Request for Back Numbers

The following back numbers of the Allahabad Farmer are out of print; Vol. I, Nos. 1, 2, 3, 4; Vol. II, Nos. 1, 4; Vol. III, Nos. 1, 3, 4; Vol. IV, No. 3; Vol. V, No. 3; Vol. VI, No. 1; Vol. VII, Nos. 1, , 6; Vol. VIII, Nos. 1, 5. As there are frequent requests for some of these, the management would greatly appreciate receiving copies from readers who are willing to help in this way.

The New York Public Library desires the following issues to complete its file: Vol. I, Nos. 1, 2; Vol. II, No. 4; Vol. III, No. 4; Vol. V, No. 3. Readers in America are requested to send copies direct to the Director, New York public Library, Fifth Avenue and 2nd Street, New York City.

METEOROLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE

October, 1934

Date	Max. Temp. F.	Min. Temp. F.	Mean Temp. F.	Percentage of Humidity.	Atmosphere Pressure inches.	Rain for the day.	Rain since Jan.	Wind direction.	Remarks.
1	88	73	80·5	75	29·46	Trace	.	E.N.E.	
2	92	73	82·5	75	29·46	Nil	27·75	W.S.W.	Preparing seed bed for Rabi crops continued.
3	92	68	80·0	70	29·49	,,	,,	E.	
4	93	70	81·5	79	29·54	,,	,,	Calm.	Harvesting *Jowar* & *Bajra* continued.
5	93	74	83·5	75	29·60	,,	,,	W.S.W.	
6	92	68	80·0	68	29·62	,,	,,	W.S.W.	Started sowing of early potato.
7	91	68	79·5	67	29·58	,,	,,	E.S.E.	
8	90	67	78·5	58	29·55	,,	,,	W.N.W.	
9	91	67	79·0	60	29·53	,,	,,	W.	
10	92	66	79·0	62	29·54	,,	,,	W.S.W.	
11	90	66	78·0	58	29·54	,,	,,	,,	
12	95	65	80·0	72	29·52	,,	,,	W.N.W	Started sowing gram and linseed.
13	95	66	80·5	65	29·56	,,	,,	N.W.	
14	93	66	79·5	60	29·55	,,	,,	N.W.	
15	90	66	78·0	52	29·54	,,	,,	W.N.W.	
16	89	69	79·0	89	29·63	0·09	27·84	N.W.	
17	83	67	75·0	87	29·68	0·28	28·12	N.	
18	86	69	77·5	78	29·71	Nil	,,	W.	
19	88	65	76·5	72	29·72	,,	,,	W.S.W.	
20	87	58	72·5	70	29·73	,,	,,	S.	Sowing early potato
21	86	57	71·5	67	29·70	,,	,,	W.	
22	86	57	71·0	64	29·66	,,	,,	W.	Sowing wheat.
23	86	55	70·5	65	29·68	,,	,,	N.W.	Running pegtooth harrow on sown potato fields.
24	86	55	70·5	63	29·71	,,	,,	N.	
25	85	56	70·5	64	29·72	,,	,,	N.N.E.	
26	85	54	69·5	65	29·73	,,	,,	S.S.W.	Harvesting of *Jowar* and *Bajra*
27	83	53	68·0	57	29·68	,,	,,	E.N.E.	
28	82	55	68·5	55	29·76	,,	,,	W.	Harvesting Napier & Guinea grasses.
29	82	54	68·0	64	29·74	,,	,,	E.	
30	82	55	68·5	68	29·77	,,	,,	N.N.W	Sowing mixture of gram and barley.
31	83	58	70·5	69	29·73	,,	,,	S.W.	

November, 1934

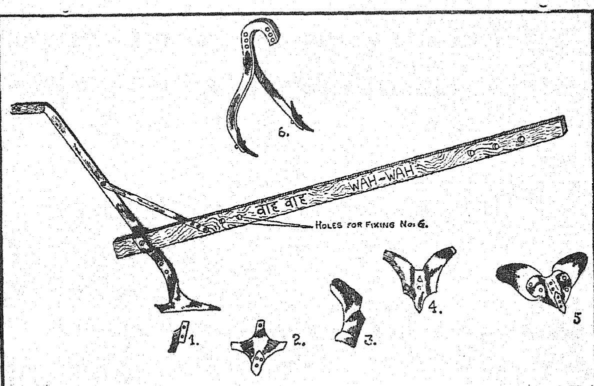
Date.	Max. Temp F.	Min. Temp F.	Mean Temp F.	Percentage of Humidity.	Atmosphere Pressure inches	Rain for the day.	Rain since Jan.	Wind direction.	Remarks.
1	82	59	70·5	76	29·70	Nil.	28·12	Calm.	Sowing of wheat, mixture of gram and barley continued.
2	75	59	67·0	73	29·70	,,	,,	E.N.E.	
3	78	61	69·5	75	29·68	,,	,,	Calm.	
4	80	64	72·0	69	29 68	,,	,,	E.	Cultivating potato. Planting cauliflower, cabbage and other minor vegetables.
5	82	64	73·0	84	29 65	,,	,,	E.	
6	76	60	68·0	80	29 70	0·25	28·37	S.	
7	80	61	70·5	68	29 68	Nil.	,,	S	
8	83	63	73·0	58	29 65	,,	,,	W.N.W	Harvesting of grain *Bajra* started.
9	84	64	74·0	57	29·62	,,	,,	W.N.W.	
10	80	49	64·5	55	29·53	,,	,,	W.	Cultivating and earthing up potato.
11	85	54	69·5	55	29·55	,,	,,	S.W.	
12	89	58	73·5	54	29·59	,,	,,	S.W.	
13	89	58	73·5	54	29 68	,,	,,	W.	
14	87	58	71·5	60	29·75	,,	,,	W.	
15	86	54	70·0	53	29·75	,,	,,	W.	
16	84	48	66·0	58	29·78	,,	,,	W.	Threshing of *Bajra* started.
17	84	46	65·0	54	29·76	,,	,,	W.	
18	84	51	67·5	52	29·71	,,	,,	W.	
19	82	52	67·0	53	29·73	,,	,,	W.	
20	82	42	62·0	55	29·76	,,	,,	W.	Levelling of land started again.
21	82	40	61·0	56	29·79	,,	,,	W.	
22	76	44	60·0	51	29·80	,,	,,	W.	Sowing of Rabi crops agan.
23	78	44	61·0	53	29 78	,,	,,	W.	
24	79	50	64·5	58	29·72	,,	,,	W.	Manuring of fields for hill potato.
25	81	52	66·5	57	29·76	,,	,,	W.	
26	82	51	66·5	60	29·75	,,	,,	S.W.	
27	76	50	63·0	58	29·74	,,	,,	S.W.	
28	74	47	60·5	51	29 74	,,	,,	W.	
29	73	44	58·5	40	29·80	,,	,,	W.	
30	70	44	57·0	44	29·80	,,	,,	S.W.	

It is announced that the Practical Training School in Rural Reconstruction which accepts students from various parts of India, Burma and Ceylon will be conducted in 1935 during the month of April at the Martandam Y.M.C.A. Rural Demonstration Centre, and in its Extension Area. Dr. D. Spencer Hatch has returned to India and will be in charge of the training. Applications are being received; and further details may be had from the Y.M.C.A. District Office, "Keston", Trivandom, S. India.

ALLAHABAD AGRICULTURAL INSTITUTE

CAN NOW SUPPLY

THE "WAH-WAH" PLOUGH WITH ATTACHMENTS



The "Wah-Wah" plough is suitable for all purposes. It works on the same principle as the desi plough, but is more efficient. The smallest country bullocks are sufficient to work it. Price complete, **Rs. 6-8**. Iron parts only, without wooden beam, **Rs. 5-8**.

SPARE PARTS AND ATTACHMENTS

No. 1. Stabilizer used with flat sweep and furrow makers.

No. 2. Flat sweep for replacement, with cultivator attachment. Has replaceable patch point, **Re. 1**.

No. 3. Meston Bottom modified for attachment to "Wah-Wah" Plough, **Rs. 5**.

No. 4. Furrow maker. Can be supplied in 10", 12", and 15" sizes, for making all sorts of furrows and ridges. With cultivator attachment can be used for cultivating, weeding, and mulching. **Rs. 3-12, Rs. 4-12, and 6-8**, respectively.

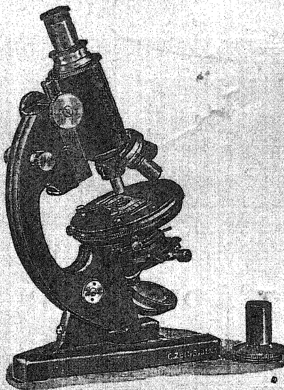
No. 5. Special furrow maker for making furrows for sugar-cane planting. Can also be used for earthing up crops, **Rs. 10-12**.

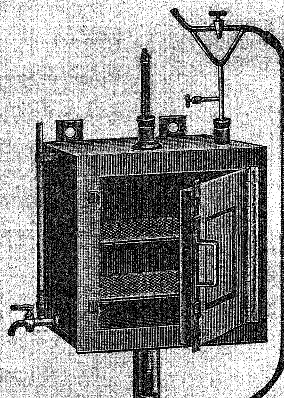
No. 6. Cultivator attachment. This is useful for interculture, **Rs. 6**.

(NOTE.—Furrow makers are imported at present, and prices are subject to change.)

Prices and particulars from—

AGRICULTURAL ENGINEER



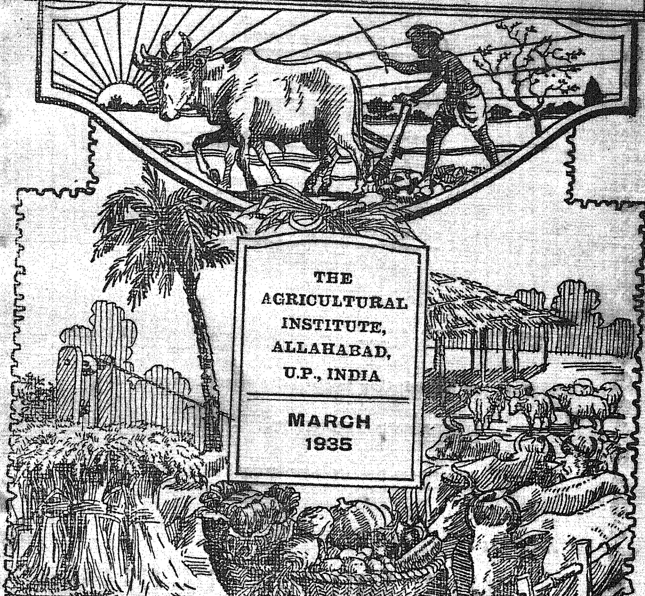


A. P. Brooks

VOL. IX] [No. 2

THE ALLAHABAD FARMER

A bimonthly Journal
OF
Agriculture and Rural Life



"We cannot consider ourselves a civilized nation until every place of human habitation is equipped with the means for sanitary disposal of human waste with its infesting and infecting organisms of disease" Prof. Haven Emerson of Columbia University, President, American Public Health Association.

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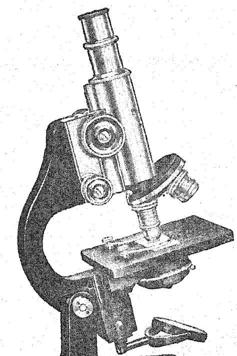

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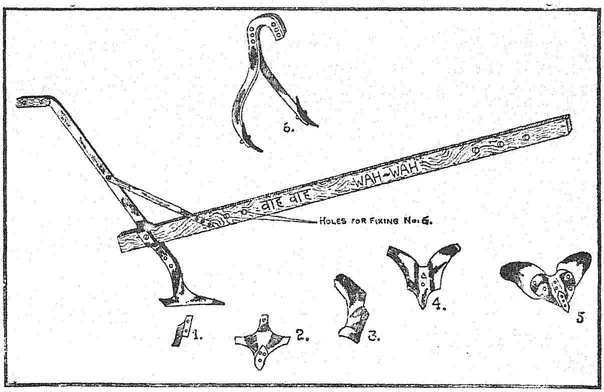

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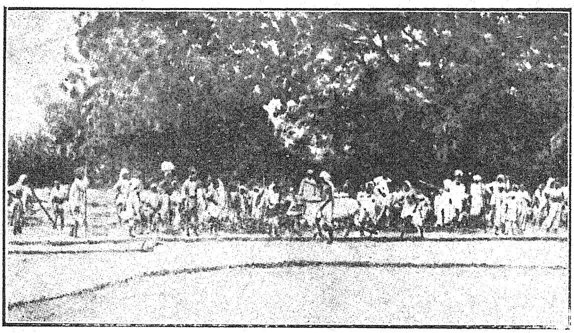
THE WAH-WAH PLOUGH IN ACTION



PLOUGHING DEMONSTRATION

SERAI AQIL

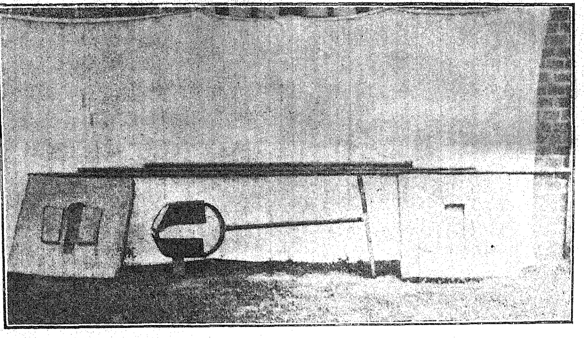
District Allahabad

The Wah-Wah plough continues to win favour and users —"better than medals and prizes; it is being bought in increasing numbers for actual use."

See Vol. VII, No. 3, May, 1933, of *The Allahabad Farmer* for a description of the "Wah-Wah" plough.

See the advertising section of the current number for particulars regarding cost.

The Bore-hole Latrine

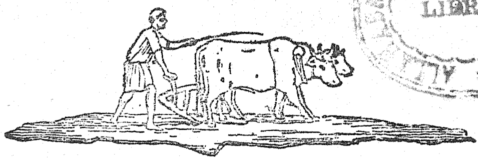


THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

The Allahabad Farmer

A BIMONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE



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A BIMONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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One half page of six numbers	30	0	0
One single half page	6	0	0
Page 2 or 3 of cover for six numbers ...	75	0	0
Page 4 of cover for six numbers ...	100	0	0

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Contributors will receive 15 reprints of the article published and additional copies at cost.

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THE
ALLAHABAD FARMER

VOL. IX] MARCH, 1935 [No 2

Editorial

Frost.

For the third year in succession Northern India has suffered from a frost which has caused wide-spread damage to crops. Over very wide areas two of the most useful pulses (gram and arhar) consumed by most of the people as a regular article of diet have been almost completely destroyed. Vegetables, especially tomatoes, sweet potatoes, and young mango trees, papayas, bananas and sugarcane have suffered. Not since I have taken an interest in the weather relative to agriculture in India have I known three successive years when frost did so much damage. For each year the damage can be measured by crores of rupees. This, coming upon a farming community greatly stricken through bad harvests and low prices for agricultural produce, is a terrible calamity.

In other countries subject to occasional damage by frost, plans have been worked out by which the damage can be mitigated. As the damage caused by frost in India is so great it might be well worth the co-operation of the Meteorological department and the Agricultural department to devise means of preventing frost damage ; also investigating what agencies would be available for spreading the information to the villagers as to when protective measures should be used. If even a fraction of the crops that are now destroyed by frost could be saved it would be worth a great effort.—S. H.

* * * *

Unemployment and Education.

Owing to the unemployment caused by the world-wide depression many people in India are questioning the present educational system. Education is vital to the progress of any nation. If the educational system is at fault it is worth much effort to re-organise it so that it can be adapted to meet national needs. As one considers Indian life and compares it with that of other countries, it seems as though there were very few opportunities for education in India leading to a better standard of living. There are so few channels open to

an educated Indian. The Government has been generous in giving foreign scholarships to selected Indian students. These have studied various technical subjects and returned to India to attempt to put what they have learned abroad into practice. Most of them find that it is impossible to get a living doing the thing for which they have been so expensively trained. Many of these men become discouraged and accept clerkly positions on very low salaries.

There is need on the part of India of realising that industrial development is necessary if India would succeed. Far too large a percentage of the population are engaged in India's main industry, agriculture. There was never greater need for improvement in agriculture than today. Acre yields should be increased and the cost of production per unit reduced. Also a greater effort should be made to improve quality. One reason for the poverty of the agriculturist today is, because there is so little demand for labour in industry ; men remain on the land, working practically bare-handed, which is at once the most expensive and the most inefficient method of production. Where labour-saving machinery is in use the cost of production is much lower than where hand production is used.

There is no cut-and-dried remedy for the present unemployment that can provide immediate employment for those who are now out of work. Planning and looking ahead by both Government and local authorities and the people in general (the latter is by far the most important) should seek to start new industries and enlarge existing ones. As one goes through the bazaars one sees all kinds of imported commodities which could be just as well made in India if the labour were properly directed. Therefore the way out of unemployment is for all concerned to unite in a planned effort to increase the use of labour-saving machinery, so as to produce more at a lower cost per unit. Men live on goods, not money. So the larger amounts of goods produced in India will be divided among the people who produced it; any surplus produced cheaply enough can be exported at a profit.—S.H.

* * * *

Rural Broadcasting.

The marvel of the twentieth century has been the phenomonal development of radio broadcasting. The invention of wireless transmission of messages occurred within the memory of the not very old and the development of the broadcasting of programmes of entertainment and instruction has occurred mainly in the last fifteen years, almost wholly within twenty years. Now, it is possible, whether in

the city or in the jungle, on mountain top or ocean wave, to manipulate a simple little switch and turn a dial and have a choice of music, drama, information, the news of the day, or instruction in a multitude of matters at almost any hour of the day or night.

As is usual with such things, they were first developed in the cities and receiving sets became common in the cities. Programmes are naturally designed for the majority of listeners, so the interests, tastes and needs of the villager have been for the most part neglected wherever they differ from those of the city dweller.

The city dweller has many sources of entertainment, information and interest open to him which are practically closed to the villager. In western countries, particularly in America where education in town and country are not widely different, many receivers have been installed in rural homes and have tremendously improved the entertainment facilities available, especially at times when travel is hindered by weather conditions. In Russia a great effort has been made, according to reports, to introduce receivers into rural areas and to adapt programmes to the needs of rural listeners.

Much has been written about the possibilities of introducing such service in India, especially for its value in making life more enjoyable to the millions of relatively isolated villagers and as a means of giving them information as well as entertainment. A few experiments have been made, often with insufficient capital and usually by men who were working single-handed as a part time interest and without the backing of a competent and experienced staff acquainted with rural conditions. The attempt has also been made to judge results by the use of one receiver or two. No experiment has yet been made by a group with rural training and experience with an adequate number of receivers over a sufficiently long period to really find out what the possibilities are of reaching the villager effectively in India with a broadcasting programme. A number of the Universities and Colleges are experimenting with the technique of transmitting ; very little is being done on programmes and reception.

The offer of a gift from America has made possible such an experiment at the Institute. We have a group trained in rural work ; we have the help and advice of competent men in the Allahabad University on the technical side of broadcasting ; we are interested vitally in reaching the villager. The Department of Posts and Telegraphs have given us a license to experiment on the programme and reception sides of rural broadcasting. The first installation of a 10 watt transmitter is nearing completion and we hope to formally open it for regular transmissions from February 27th. Some six or seven receivers will be placed

immediately in surrounding accessible villages. In a short time we hope to get the necessary results to justify us in deciding on a suitable type of receiver and to get parts necessary to increase our power to 100 watts to enable us to cover a considerable area. If and when funds are available we propose to increase the number of receivers.

We are going into this scheme definitely as a research problem. We hope to get definite data on what type of programme material appeals to the villager; the proportion of instruction and the subject matter which can be mixed into the entertainment without losing the interest of the people; how far the villager will benefit from the advice and information offered; and generally study the problem of "getting across" to the villager. We believe that this information will be of vital interest to future workers on this subject.

The second thing we wish to experiment with is the receiver installation. Estimates that have appeared in the press from time to time have seemed to us fantastically expensive in many cases and out of the reach of the ordinary village group. We consider that there is a place for a comparatively inexpensive installation which can be heard by a small or moderate sized group with satisfaction. We think it may easily be possible that the introduction of several such small installations in one village, each serving a family or caste group, may be much easier than one big installation serving the whole village. At least, we wish to explore this possibility. We wish also to test out some of the different circuits and types of cheaper receivers available and to experiment with the means of supplying them power when far away from electric mains or facilities for charging storage batteries. The Low Tension accumulator and High Tension dry batteries are very convenient and suitable for the town dweller with a charging station around the corner and able to afford the cost of dry batteries. We shall try various other methods of accomplishing the results in the hope of finding something cheaper and as good if not better for our purpose.

Our call sign will be VUA, and our wavelength 280 meters. While our installation will not reach all over India or even over the U.P., we will be grateful for reception reports of any who are able to get us. We will also appreciate comment on our plans, suggestions as to programme materials and any suggestions on the technical receiver construction and maintenance problem any one may care to give. We are not interested in proving a theory, we are interested in getting the facts and in making them available to those who can use them.—M. V.

The Pink Boll-Worm Pest of Cotton and How to Control it.

This is the title of the leaflet issued by the Indian Central Cotton Committee and which was recently received by us. We would like to draw the attention of the farmers who are growing cotton to the very practical suggestions for controlling the above-named pest which is doing so much damage to the cotton crop in Northern India. The damage in the United Provinces done by this pest is about one-third of the crop. The insect, which is a moth, does its greatest damage when in the caterpillar stage. The young caterpillar (worm) is at first white in colour and becomes pink as it grows bigger, hence the name pink boll-worm given to it. The worm gets inside the cotton ball and feeds on the growing seeds.

The leaflet recommends the heating of the cotton seed to a temperature of about 140° Fah. for a few minutes. At this temperature the caterpillars are killed. Under village conditions the seed may be thinly spread out on the floor and exposed for about two hours at midday on any hot day during the month of April or May. All seeds in the villages should be heated as moths will fly out of these seeds if left untreated. For treating seeds on a commercial scale a Simon Heater is recommended. This is a steam-heated machine which automatically regulates the temperature to which the seed is heated. This heating does not destroy the vitality of the seed in any way but, on other hand, improves its keeping quality.

The leaflet also recommends prohibiting the importation or retention of infected seed after a given date.

Vinca rosea or PERIWINKLE, known in Hindustani as GULFIRING, is a very common evergreen flowering plant in the plains of India. It is a small plant and is generally grown in gardens because of its resistance to drought. Its flowers are either pink or white. It, however, sometimes grows as a weed on the farm.

Mr. C. T. White, a Government botanist of Queensland, claims that the leaves of this plant are as good as insulin in the treatment of diabetes.

The leaves, about twenty-seven of them, are taken and boiled for fifteen minutes in three and a half cups of water, and then strained. Each cup of this should be taken after each meal and this to be followed after an hour by half a glass of warm water in which a little bicarbonate of soda has been dissolved.

SOIL CONSERVATION AS A MAJOR AGRICULTURAL PROBLEM.

By Mason Vaugh, B. Sc., A. E., Agricultural Engineer, Agricultural Institute.

The agricultural soil is probably man's most precious natural resource. Useful as other natural resources are, the coal, iron and other minerals, petroleum and water power, none can compare with the soil in importance. We have not succeeded in getting any important part of our food without the soil being concerned somewhere in the process and we are not likely to be able to do so. So far as we can see, the soil is likely to remain necessary to the continuance of human life.

The soil is a complex substance, compounded of mineral particles of varying composition and organic matter in varying amounts. The kinds of soil are almost infinitely varied in chemical constitution, physical structure, origin and fertility. Not unimportant is the bacterial and fungoid life contained in it. While we try to classify soils into groups and kinds, the variation is really infinite, one shading into the other in infinite variety. While the bulk of the soil is mineral matter, the organic matter content is of the greatest importance in determining the physical condition and fertility of the soil.

Soil is subject to deterioration in many ways. Excess or deficiency of water, deficiency of certain elements, both mineral and organic, erosion and the accumulation of certain soluble salts may all cause the deterioration of soils. Of all these, I propose to speak of three as being of major importance in India—depletion of organic matter, soil erosion and alkali or near formation.

The system of farming with the *deshi* plough as the principal implement and with the application of very moderate amounts of manure, in some cases none, has resulted in most Indian soils having nearly the minimum possible organic matter content. No other single thing would so improve Indian soils as an increase in the organic matter content. It is difficult to over-stress the importance of this point. Much organic matter is wasted which, if composted with the barnyard manure, would go to greatly enrich the soil. With soil inverting ploughs, green manuring becomes possible. While certain chemical fertilisers may be useful, and in some cases important, none of them can compare in importance with maintaining and increasing the organic matter content of the soil.

While lack of organic matter is important, it is an old problem and Indian agriculture has become adjusted to it—it is accepted as a settled thing, part of our fate, inevitable. Two other problems are of increasing and possibly greater importance. I refer

to soil erosion and alkali formation. With the inevitable changing of smaller into larger farms, the joining of several fields into one, erosion will be an increasing difficulty unless we take steps to prevent it. Fletcher says "People of other countries have followed their soils from the uplands to the valleys and deltas where they carry on a more or less crowded existence fighting flood, famine and disease." The whole of the Indo-Gangetic plain, most of North India, as well as large areas in South India, is alluvial soil, eroded from the mountains and pausing on its way to the Bay of Bengal or the Indian Ocean. It is a mistake to think that it is stable, that it has finished its journey; it has only hesitated, stopped over night. Whether it will stay or go on depends on our treatment of it.

Large areas in the U. P. are unfit for cultivation now because of erosion. I have seen no official figures of the area but I would guess that it would be measured in lacs of acres. The process is going on incessantly, year by year the area increases. Some of the best land on the farm of the Agricultural Institute of Allahabad is the old *nala* which has been filled with dirt from our neighbours' fields —they were allowing it to be washed away and we have caught and saved it to our mutual advantage.

Erosion is of two types, so-called sheet erosion in which a continuous layer of soil is removed from the whole surface, and *gully* erosion in which the land is cut up by *gullies* or *nalas*, making the surface uneven and usually unfit for cultivation. Both types are usually associated on the same area, the sheet erosion slowly stripping off the surface soil and the *gullies* carrying it away.

Erosion is the carrying away of the surface soil by running water. Water runs or flows only down a slope. On a smooth surface, doubling the slope increases the velocity some 16 times. Doubling the velocity increases the power to carry soil 32 times. The velocity controls the amount of soil carried. To a large extent, on bare soil, the slope of the land determines the velocity, modified by the condition of the soil as to smoothness and compactness and by the presence or absence of vegetation. Flat level land generally does not suffer from erosion. Land well covered with vegetation, forests or grass land not too heavily grazed, ordinarily is not eroded unless the slope is very severe. Cultivated land with a loose, highly absorptive surface does not erode in light rains of short or moderate duration but may erode severely in heavy rains of long duration or of very high intensity. Cultivated land covered with a dense crop is less eroded than bare land or land in clean cultivated crops. Of course, erosion is a phenomenon of the rainy season or in rare cases of the period of irrigation.

The foregoing statements give us clues to the control of erosion. If we prevent runoff of water from the fields entirely, we

prevent erosion entirely or at least confine it to the transport of soil from one part of a field to another. This is the method which has been attempted in the past in India. In general, there is keen competition for level or nearly level land and sloping land is only cultivated if and when nothing else is available. As rapidly as possible, land not level is levelled into flat bench terraces, each surrounded by a bund which will retain all of an ordinary rain on the land. This works very well as long as we have only small fields and light rains. If we want larger fields as it will be necessary for us to have if we wish to use even the smaller sizes of bullock-drawn seeding and harvesting implements and machines, the levelling of the land, into bench terraces becomes fantastically expensive—prohibitive if the land is to return a profit on the investment Also, the height of bund necessarily becomes very expensive both in cost of construction and in the area of land occupied if we attempt to retain all the water on the fields. It is necessary for us to provide for some runoff at least during the heaviest rains if we are to avoid reducing yields due to waterlogging. Of course the erosion can be lessened appreciably by removing the excess water by under drainage but this is unnecessarily expensive in first cost and removes an appreciable amount of soluble-available-plant food by leaching. Surface drainage is all that is required and it is possible to have surface drainage without erosion.

Of course we should try to absorb as much of the rainfall as possible by every means in our power. The addition of organic matter, proper cultivation of the soil, causing runoff to be as slow as possible to give time for absorption, all these should be practised. Short of waterlogging, the more water can be absorbed the better, provided water is not held on the surface more than a few hours at a time.

While irrigation is a very important matter in U. P. agriculture, large areas of crops in the province are raised completely without irrigation or with very little. There are certain elements of convenience in irrigating level or nearly level plots. It is not necessary to have level land in order to irrigate it—I even doubt whether it is desirable to have land entirely level for irrigation. Certainly, the advantages of having the land level will not justify the high cost of levelling it into fields large enough to use seeding and harvesting machinery of a bullock-drawn type. It is quite practicable to irrigate both row crops and broadcast crops on fields with considerable slope.

In my opinion, the utility of the bench terrace in preventing erosion or in facilitating irrigation has been over emphasized. The banks breed weeds, reduce the area available, make difficult, if not impossible, the combination and sub-division of fields to fit

different crops and different implements and secure no advantages which cannot be more cheaply and better secured in other ways. At presant the bench terrace is an obstruction to the introduction of better methods. As the, to me, inevitable changes in Indian agriculture go on, it must be replaced by something else which will enable us to control erosion on larger areas.

Erosion control falls broadly into two main divisions, the checking of the flow of water by use of vegetation and checking the flow by controlling the slope down which water flows. The use of vegetation on cultivated lands is confined to the use of cover crops and of strip planting. A cover crop is a crop planted between major crops, to cover the soil and prevent erosion during the time when the major crops are not on the field. Any produet of it beyond this is incidental, the purpose being erosion control and not yield. Generally in America, but not always, the cover crop is a legume and is used as a green manure. The requirements are that it be dense, low growing and that it not rob the soil of readily available food needed by the next crop. Little work has been done on this in India and research is needed. The various low-growing pulses seem to offer most hope. Such a cover crop grown during the rains has often been found to increase the moisture available for the following crop. Strip planting is simply the planting of alternate strips of cultivated crops and cover crops, the area in cover crops during the rainy season being put into winter crops later. The strips should be 10 to 20 yards wide according to the slope.

Mechanical methods of checking soil erosion consist of proper methods of ploughing and planting, the soil saving dam and the Mangum terrace. On sloping land, ploughing before and during the rains should be across the slope and not up and down. Ploughing just after the rainy season when the soil will again be thoroughly consolidated before rain again falls may be in any direction. Row crops should be planted on lines across the slope and if the land is uneven, on contours.

The soil saving dam is a device for checking gully. Essentially, it is a dam, usually of earth, across a *nala* or gully with a *pakka* spillway. It provides a sudden drop over masonry which can withstand the eroding effect of the water as an alternative to the former gradual slope. The dam checks the flow of water, forming a pool or tank in which silt gradually accumulates, filling it up. The slope of the *nala* becomes more gradual and soil is either not eroded or is deposited in the *nala*, reclaiming the land for use. A series of dams may be put at intervals as needed. The spillway must be *pakka*, sufficient in size to pass the full flow of water and definitely lower then the earthen dam so the outflow of water will always be over the *pakka* spillway. The cost of even a fairly

large soil saving dam is not great. Often the increase in crops grown will annually repay the cost of building the dam in full. Few other investments will pay cent per cent on the original cost.

Time and space do not allow a full description of the broad base terrace. There is considerable literature available on the subject in the form of bulletins of the United States Department of Agriculture and in bulletins of the State agricultural services of many of the States. Most American books on drainage have chapters on the subject. Briefly, the Mangum terrace is a wide low ridge, 25 to 35 feet across and 18″ to 24″ high, constructed across the slope to catch and carry off, at a slow rate, the surplus water. Such terraces are constructed at intervals so that the vertical distance between them is from 1′ to $5\frac{1}{2}$′, the smaller vertical distances being for the flatter slopes. The sides of the ridge slope so gradually that farm implements of all sorts can cross them quite easily and the cultivation is carried on just as though they were not there in most cases. It is desirable that dead furrows from ploughing should not cross the ridge directly and that ploughing strips or lands be laid out so that the ploughing tends to rebuild the terrace instead of tearing it down. Lands sloping more than 1 per cent. can be terraced beneficially and those sloping more than 3 per cent. to 4 per cent. should in all cases be terraced. The terrace ridge should slope gradually in one direction and adequate provision should be made for outlets to care for the water discharged by the terraces.

The other form of soil conservation that needs definite attention is the prevention of *usar* or alkali formation. So-called *usar* or alkali is simply an excessive concentration of soluble, non-food salts in the soil which are not used up by the plants. Though not exclusively, they are definitely associated with irrigation. They are characteristic of desert soils in general. Practically all arid or semi-arid soils have considerable amounts of soluble salts. These are generally distributed throughout the soil and when so distributed rarely do harm. When there is excessive evaporation from the surface, usually the result of the water table being within 3′ to 4′ of the surface or to such heavy irrigation as to constitute temporary waterlogging, these salts tend to accumulate until they hinder or prevent plant growth, probably by interfering with osmotic action of the roots due to the soil solution being more concentrated than the root solutions. In the history of the world, only Egypt has an agriculture based on irrigation which has survived over thousands of years. All others have succumbed, generally to alkali.

Once alkali is definitely established, little can be done about it except the slow erosion of the surface by wind and water, carrying away the surface soil. Prevention is the only really effective

method. Mild alkali can often be redistributed deep into the soil; occasionally but rarely, it can be washed away. Much so-called *usar* land is not really alkali; it is only waterlogged and trampled to death by cattle during the rainy season. Such land can be reclaimed by surface drainage of a simple kind, ploughing and keeping cattle off it. Such treatment for a year or two to get it into good physical condition is all that is required.

Prevention of the more serious types of usar formation is definitely a matter of control of water. Either extreme economy or extreme lavishness in the use of water is bad in an arid climate. Where the rainfall is 30″ or more, especially if it comes in a monsoon, the situation is automatically cared for. In an arid district or where rainfall is light and irregular, excessive economy of water does not provide for either washing from the surface or deep percolation. It is supposed that the garden of Eden was ruined this way.

Excessive alkali is more commonly the fault of a high water table. The farmer has usually been blamed for causing a rise in the water table due to excessive application of water. I think the trouble is much more often the leaky canals. Lining the canals or heavy pumping from wells to lower the water table is the only way in most cases. A water table closer than 5′ to 6′ from the [illegible]ce is dangerous as water will definitely move into the normal [illegible] zone from a depth of about 3′ below the actual roots. Considerable areas have already been either ruined or seriously damaged. Steps should be taken to prevent further damage.

In general, erosion control is in the hands of the individual cultivator. Each man can care for his own problem with or without the help and co-operation of others. It is not necessary for the state to intervene beyond disseminating knowledge. Usar is commonly a more widespread thing and affects larger areas. Its control will in most cases involve state intervention.

"*Washing With Linseed Oil Removes Stains from Skins*:—House cleaners can take spots of lacquer dye, etc. from their hands with the old familiar paint ingredient, linseed oil. So says INDUSTRIAL AND ENGINEERING CHEMISTRY quoting a German source.

About a thimbleful of the oil is all that is necessary, Rub it thoroughly over the hands until the offending spots are "out"; then without removing the oil, wash the hands in warm water with plenty of soap. The soap takes off the stain and the excess oil, but leaves enough of it to keep the skin soft and smooth."

—SCIENCE NEWS LETTER.

OUR PUSA TRIP

By S. N. Gupta. (Student, II Year Class)

It was a new year's evening. We started from the Allahabad junction by the Sealdah express at 11. 34. It was a dark night and little could be seen outside the train on the lands we were rushing through.

Early in the morning we reached Patna. The blue light of the dawn was spread over the ancient city of Pataliputra, the capital of India in the times of the Gupta and Maurya dynasties. We had twentyfour hours' stoppage here and Mr. Lacy drew up a programme for us to see the various important places at Patna.

The weather was not good. It was cloudy and rain was falling. The trees and grass were dripping wet. Our company walked about two miles to Gol-Ghar, the famous granary of Patna. Pierced through the sky it presents its magnanimous view to a visitor from a distance. We went up the top of it from where it gives a very beautiful bird's eye view of the whole city. We saw the Ganges loitering slowly over the flat lands of Bihar with the green flowering crop along one side and the large city along the other with tall palms and clusters of trees, parks, law[illegible] pretty gay flowers of various colours, and the palatia[illegible] scattered amongst them. From here we went to see th[illegible]. There we saw the Secretariat and the Council Chamber and returned to the Medical College. Then we went on motor buses to the Cottage Industries Institute. It was closing but we saw some of the things there.

Early in the morning, on the 3rd of January, we went on motor buses to Digha Ghat. We boarded a steamer at about 6 a.m. for Paleza Ghat. It was about half an hour's journey across the Ganges. We had a fine time—pleasant scenery and cheerful company. It was an eastern landscape and the orange rays of the rising sun reflected on the white sands of the Ganges gave a sensation of joy.

When we reached Paleza Ghat, a B. & N. W. Railway train was ready to take us to Muzaffarpur. After a while we were travelling through the strange lands (strange to U. P. students) of northern Bihar on a slow train. On both sides of the train we saw flat lands with rough surface at places and patches of tall grass here and there. Small muddy pools were often seen. Mango, lichi, shisham and bananas were everywhere seen. There were many lichi plantations along the railway line. Crops were abundant and rich. Sugarcane was very common. Chillies and turmeric were the special feature. Turmeric was mostly grown with pigeon pea. Wheat, barley and mustard were all flourishing.

After short intervals we came across huts with small vegetable plots, chillies and turmeric and rows of bananas. Palms were also present in the hedges. Sometimes we had a glimpse into the poor simple household of the farmer. We saw many small sugar factories near the stations. Cattle were small and weak: people were black and meek. We reached Pusa Road station at about 2.45 p.m.

The Pusa Imperial Institute is about seven miles from the station. Those people had sent a motor bus for us. We sent all our luggage on the bus and started on *ekkas*. The crops we saw on the way were very good. We felt as if we were travelling through gardens. The soil was almost dirty-white. This is perhaps due to the presence of potassium nitrate in the soil. It is a very good fertilizer but as a rule, when in excess, it is harmful and produces alkali lands.

Our party reached the Guest-house at Pusa at about 4.30 p.m. We had a comfortable accommodation here. In the evening, some of us went for a walk round about. The arrangement of the farm was all very decent. The roads were well laid out and the buildings were well placed. The main college building, which was very grand, was badly damaged by the earthquake. Outwardly it appeared as if it was a matter of a few thousands of rupees to repair it. Only some bricks had fallen here and there. But when we had a close look and peeped inside the rooms we found it very badly damaged Every wall in the building was cracked. There were big fissures inside the rooms : drains were upset ; the plinth had gone down two or three feet on one side. It was very dangerous to go in, so we saw what we could from outside.

Botanical section.—Next morning, on the 4th of January, at about 8 a.m. we started to see the Institute. First we went to see the botanical section, where Dr. Pal, an Economic Botanist to the Government of India, showed us the museum. Then we were taken round the fields of the Botanical section and were shown the different varieties of the various crops grown.

Wheat :—The types of wheat recommended by them are Pusa 4, P. 12, P. 52, P. 80-5, P. 101, P. 111, P. 114 and P. 165.

P. 4 is a very famous variety of Indian wheat. It has been said to be the best wheat and has a good reputation in foreign countries. It has a great demand in Europe. It competes with Manitoba wheat there in producing good loaves. It is specially recommended to the north-western part of India. This wheat has been introduced in Australia and South Africa also. It is beardless. The grains are big and plumpy. It is rust-resistant and does not tiller. The yield is not very high—about 18 maunds per acre.

P. 12 has a higher yield than P. 4 but the bran is very thick so the milling quality is low. It is also beardless and rust resistant.

P. 52 is a bearded variety. It does best in Bihar and Orissa. The milling quality is also good.

P. 101 is a short-seasoned wheat. It is much grown in Bihar.

P. 111 is a natural selection out of P. 4. It is now beating P. 4. It makes very good loaves. The yield is comparatively high. Europe imports large amounts of it now.

P. 111 is a bearded variety. It is recommended for Sind where irrigation is plenty.

Barley :—The types recommended are T. 21, T. 24 and T. 25. T. 24 is a naked or hulless variety. Hooded varieties are generally hull-less.

Oats :—The varieties recommended are B. S. (Botanical section) No. 1, B. S. No. 2 and hybrid J. We were told that the Indian oats (*Avena Sterilis*) are longer and thinner while the European oats (*A. Sativa*) are plump and shorter. In India, they are generally grown in dairy farms and on the hill stations as fodder for animals.

Paddy. They have isolated 123 types of paddy. In the western part of India, the long, scented grain is in demand but in the eastern part, they like round or oval varieties. The types recommended are—T. 9, T. 18, T. 24, T. 31, and T. 52.

T. 9 is a deep-water paddy. It is recommended in parts where the water level is high. It has the characteristic of growing in water. As the water level rises in the fields, the plant also grows up.

T. 18 is a long and thin variety, mostly grown in the northern parts of India.

T. 52 is a scented variety.

Gram :—They have 84 types of gram. The types recommended are Nos. 17, 18, 25, 58 and P.F. (Pusa Farm) No. 3 and P.F. No. 11.

P. F. No. 3 is the best type. The yield is high, next to P. F. No. 11.

P. F. 11 has the highest yield but the testa is black.

Kabuli grams are bigger and white, but the yield is low.

Linseed. 124 varieties have been isolated. Now they have produced some hybrids also which have much higher oil-content. The varieties recommended to the peasants are Nos. 12, 121, 124 and H. (hybrid) 63. In H. 63 the oil-content is 43 per cent.

There are two main varieties of linseed grown in India—small-seeded ones and large-seeded ones. The small-seeded varieties are grown in northern India. They have shallow root-systems. The oil percentage is also low. Large-seeded varieties are grown in southern India. They have deep root-systems. The plants are large and the oil percentage is higher—up to 40 per cent.

Arhar (Pigeon pea) :—This is one of the most important pulses but it is often badly damaged by wilt. Wilt disease is

caused by certain fungus which first gives rise in the soil. From the soil, they find their way to the roots of the plants. They check all the water going up to the shoot. Then the plant wilts and dies. There is no apparent remedy for this disease. In order to prevent the occurrence of the disease the resistant varieties which have lately been produced should be grown.

The wilt resisting varieties are T.51 and T.80. T.51 is a cross-bred from No. 5 and T. 80. It is erect and wilt-resistant. It is now the best variety. The yield is about 20 maunds per acre. T. 80 is a spreading variety; so farmers generally do not like it. They like erect varieties which are convenient to handle.

No. 5 is an erect type. The flower is pure yellow and the inflorescence is compact. It is a very good type but at the same time it is very susceptible to wilt.

Pea :—No. 29 is a dwarf variety but it is a heavy yielder. The pods are large and the grain is sweet. The yield of this pea is 80 maunds per acre.

Sesamum (Til):—The varieties recommonded are types 3, 7 and 29. Nos. 3 and 7 are early, erect and white-seeded. No. 29 is a late and branching type. It is black-seeded.

Chillies.—They have about 40 types of chillies at Pusa. Some are very tiny and some are very big. The smaller ones are usually very pungent. The types recommended are Nos. 34, 41, and 51.

T. 34 is recommended for general purposes. It is sown in June at Pusa and transplanted after a month or so. The yield is 80 maunds per acre. But when dried the yield comes to about 15 maunds.

Tobacco :—The types they recommended are T. Nos. 142 and 177. Both are for cigarettes. These hybrids are crosses between Adcock and T. No. 28.

Hibiscus.—(Patson).—They had a new hibiscus plant in the museum. It was about 10 feet long. They had imported some seeds from Java and when the seeds were sown, this hibiscus was found growing amongst them. It gives long fibre of good quality.

We then saw the flue-curing house for tobacco and other places. Then we went on to the Chemical section.

Chemical Section.—In this section we saw various experiments being carried on. The method of clarifying sugar-cane juice by means of activated charcoal attracted our attention.

They make a bed of activated charcoal about 6″ thick over a layer of small gravel. The juice is first heated and freed from the scum that comes up and other impurities, as usual. Then the juice is poured over this bed. The process is rather slow but the filtrate obtained is very clear. It gives a clean jaggery and refined sugar.

Activated charcoal is a pure form of charcoal. It is now being prepared from the paddy husk. The paddy husk is charred in the absence of air; then it is acted upon by alkali and finally well washed. This gives activated charcoal. Its cleansing property is very strong. It can be had at a very cheap price as it is cheaply produced. Its use in the sugar industry is proving very successful and profitable.

Mycology Section.—In the afternoon we went to see the mycology section. We saw two types of smut of barley—loose smut and covered smut. Loose smut is outside and the covered smut inside the glumes. The prevention from this disease is carried on by hot water treatment of seeds before sowing. The seeds should be immersed in water at 85°-90° F. for about 15 minutes or so. Finally, they are dried before being sown. Spraying seeds with formalin diluted with equal quantity of water also prevents smut. Soaking the seeds in water for 4 to 12 hours and then drying them in the sun is the most practical method of preventing smut for the farmers. In the case of Juar seeds, putting the seeds in 2 per cent. solution of copper sulphate for 10 to 15 minutes proves very successful.

We then saw the pineapple disease of sugarcane. Then we saw the rust disease of wheat. There are various types of rust. Three types attack wheat—yellow, orange and black. Yellow and orange types are confined to the leaves and the black type to the stems. No suitable remedy has so far been found. The only way to prevent the spread of the disease is to sow the resistant types.

Then we went to the **Bacteriology section** where we saw specimens of the betel-vine disease, and of the late blight of potato. For the last mentioned disease the plants should be sprayed with bordeaux mixture twice a month. If it is the beginning of the disease, the unaffected plants will be saved.

At the **Entomology Section** we saw collections of various insects decently set up and labelled with complete life-histories of the important ones. We saw silk moths and weevils, many of which are of very great agricultural interest.

Weevils, commonly called bruchus, cause a considerable loss in grain stores. The best method of control is fumigation with carbon bisulphide (CS_2) which is the best insecticide. One ounce of carbon bisulphide is enough to fumigate 15 cu. ft. of the grain receptacle or bin. The bins are kept airtight while being fumigated, and the fumigant is put in a saucer above the grain. The process should not exceed 24 honrs for it produces a bad effect upon the germinating capacity of grains. Upto 24 hours, 96 per cent. of the grains are found to germinate perfectly well. In the fumigation of stores, there are some factors to be considered. They are

(1) Temperature and humidity, and (2) The type of insect. Then there is the effect of the fumigant on the germinating capacity of the seeds to be considered. The process is, however, not expensive. One pound bottle of carbon bisulphide costs about Re. 1-7.

Dairy Section.—The next morning on the 5th of January we went to see the dairy section. They are improving Indian breeds here. They say that the Indian cattle are the best for India; that they only need improvement; and that it is no use importing foreign bulls and with them foreign diseases; for though in previous generations cross breeds are high milk producers and the bullocks are vigorous, in later generations they are susceptible to many diseases and fail; they are good for commercial dairies only.

The three important breeds of Indian cows, we were told, are (1) Sindhi, (2) Sahiwal or Montgomery and (3) Hariana or Hissar.

The Sindhi is a very good milk breed. But cows carry big milk bags, so they are very susceptible to mammary diseases. Pre-milking is needed. The breed is not good for draught.

The Sahiwal is also a good milk-breed. It is not good for draught. It is hardy but slow. A cow produces 8 or 9 calves. The lactation period is about 10 months.

The Hariana is a dual purpose breed. It is good for milk as well as for draught.

They have here 6,000 lbs. of milk per lactation as a standard for breeding. The sire and dam are carefully selected. First the parentage is looked for, then their own characteristics are determined. The bull must have the potentiality of transferring the best hereditary characters to the progeny.

The usual time of serving heifers is at two years of age with specially fed bulls at three years of age. It is said that at the time of service the parents should not be of tender age, otherwise the progeny is weak, but they have served here 1½ year heifers with 18 month bulls and found the progeny quite satisfactory. Bulls are allowed service once a week. Well-grown bulls can give 100 services in a year. They work up to 8—9 years. The cows are usually served 3 months after calving.

Pregnant heifers are kept in separate barns so that due attention may be paid to them. A few days before calving, they are given pre-milking so that by the time they calve, they become habitual to it.

The normal weight of a calf at birth should be 40-50 lbs. They have now derived a formula for this—calf's weight $= \frac{\text{2 dams' weight} + \text{sire's weight}}{50}$. Any calf below this weight is considered to be defective.

Cows are milked four times a day—at 8 a.m., 2-30 p.m., 8 p.m. and 2-30 a.m. By milking four times they give about 40% more milk than what they give when milked two times only. The cows

that do not give over 20 lbs. of milk are milked only twice a day as it does not pay to milk them four times. As the milk-yield increases, a cow gets 1 lb. of concentrate more for every 3 lbs. of milk. The highest yield of milk of Indian cows here is so far 45 lbs. a day. The average fat percentage is 5·00

The calves are artificially fed. They have two scales of ration—Special scale ration and Ordinary scale ration. In a special scale ration, the calves are fed upto 10 months and in the ordinary scale ration, upto 6 months. The calves mature about 6 months earlier in the special scale ration and on the whole the heifers give one calf more. So, though special feeding is expensive, it pays in the long run.

SPECIAL SCALE RATION FOR YOUNG CALVES PER DAY.

Age in weeks.	Whole-milk in lbs.	Skimmed milk in lbs.	Grain in lbs.	Salt in ozs
1 to 2	8	×	×	1
3	10	×	×	"
4	"	×	1	"
5- 8	12	×	"	"
9-12	14	×	"	"
13-19	10	2	$1\frac{1}{2}$	"
20-27	8	4	2	"
28-36	6	6	3	"
37-40	4	6	4	"
41-44	×	"	"	"
45-48	×	4	"	"

ORDINARY SCALE RATION FOR YOUNG CALVES PER DAY.

Age in weeks.	Whole-milk in lbs.	Skimmed milk in lbs.	Grain in lbs.	Salt in ozs.
1 to 2	8	..	..	1
3-4	10	..	..	"
5-8	12	..	$\frac{1}{2}$	"
9-10	8	2	1	"
11-12	6	4	"	"
13-14	4	"	"	"
15-16	"	"	$1\frac{1}{2}$	"
17-18	2	6	2	"
19-20	"	4	3	"
21-24	"	"	"	"

Cattle are given full freedom to live a natural life. They are allowed to eat, drink and roam about in the enclosures as they like. In feeds they are given I, Fe, Cu and Mg along with $Ca3\ (PO_4)2$ in the mineral mixture. Also they are given something green to eat throughout the year.

Farm.—After finishing the dairy section, then we went round the farm. The area of the estate is about 1,400 acres, of which about 700 acres are under cultivation. The main crops grown (apart from experimental crops) are maize, arhar, sugarcane, cowpea, oats, barley, wheat and gram. Maize does very well here.

We saw Berseem or Egyptian clover. It is a very good fodder. They prepare the seed-bed in October and irrigate the field. Then they puddle the soil and broadcast the seed (20 lbs. per acre) over 2-3 inches of water. Irrigation is given once a month. In $1\frac{1}{2}$ months, the crop is ready for the first cutting. Then they get one cutting after every month. The final harvest is in May. About 500 maunds of fodder are obtained in each cutting. It is put in silo pits in alternate layers with Bhusa. Berseem grows more luxuriantly when trampled over, so they allow the cattle to graze over the fields freely. The fields are flooded every three years.

They practise here a three-year rotation—

1st year—Maize : oats.

2nd year—Maize mixed with Arhar or some other legume for Rabi.

3rd year—Karif pulses or green manures (Sun-hemp, Guara, Cowpea, Methi, Soya beans and velvet beans) and oats (Wheat barley, or sugarcane may be substituted)

Soya bean is a very common crop. It is a good legume and enriches the soil. They feed it green to cattle. The grain is also used mostly for cattle. It has three varities—Yellow, chocolate and black. The black variety matures about two months earlier.

Then we saw the manurial experimental plots. They use here three main methods for experiments—(1) Bevan's half-drill method, (2) Latin square method, and (3) Randomised blocks method. Super phosphate does better in many cases. We were told that the potatoes from a field that was given farm-yard manure rot soon in store.

Experiments have been done on the comparative value of different green manures and sun-hemp has been found to be the best.

Machinery Department.—We saw here the Egyptian ploughs, Gujrat drills (used for levelling), sugarcane rollers, Amscore seed-drills (they work about 15 acres a day : pulled by tractor), manure-spreaders, sub-soilers, chain harrows (for weeding), and the wooden scrapers which are mostly made of Shisham wood. We also saw some tractors, threshers and grain-graders, there. A hand winnower was then in operation cleaning soya beans.

In the afternoon, we went to see the **sugarcane plots**. We saw different varieties of sugarcane grown under experiments. The varieties recommended are Co. 210, Co. 213, Co. 214, Co. 281. Co. 299, Co. 331 and Co. 339.

Co. 210—It is an early cane. The maximum percentage of sucrose is 15·71.

Co. 213—It is a mid-season cane. The sucrose percentage is 17·34.

Co. 214—It is the best of early canes. The sucrose percentage is 17·68.—It is sold at a higher price in the market. Other canes are sold usually at As. 5-6 per maund while this is sold at As. 5-9 a maund. The millers give a premium to the growers at An. 1 a maund.

Co. 281—It needs irrigation. The gentleman who took us round said that it is probably good for U. P. The sucrose percentage is 18·23.

Co. 299—It is an early cane and gives better outturn than Co. 214. Also the sucrose percentage is higher—17·92. So it is the best for the cultivators to grow for the mills.

Co. 331—It is a late cane and matures up to May. The yield is high and the sucrose percentage is also very high 18·53.

Co. 339—The percentage of sucrose is high but the outturn is low.

In the evening, we had a walk by the side of the Gandak river which flows along the margin of the Farm.

Next morning, on the 6th of January we started back to Muzaffarpur. We reached Muzaffarpur at noon and stayed there the whole day long up to 9-30 in the night. We saw the tumbled down city and the earthquake colonies. Business houses have been rebuilt more or less but most of the residences yet lie in a state of total collapse.

At 9-30 we started from the station for Gorakhpur. We had a whole night journey on the train and reached Gorakhpur early, in the morning of the 7th January. We went to St. Andrew's College where we were accommodated.

At 8-30 a.m., we started to see the Government Experimental Farm there. It is a very good farm though it looked to us quite simple as we had just returned from Pusa. Different varieties of pea, sugarcane, wheat, barley, gram and linseed were under experiment here. There were some sorghum crosses of sugarcane. Manurial experiments were also being carried on.

Jaunpore pea gave the highest yield here last year—about 15 maunds per acre. Co. 210 and Co 213 are the standard canes here. Co. 313 and Co. 331 are the best of the late ones. Co. 285 proves more hardy than Co. 205. Gram No. 58 does the best. Of wheats, P. 165 is the best. For linseed, they said T. 50 is the best but the best linseed in the farm was E. B. 1150.

They have four year rotation here:

1st year—sugarcane
2nd year—wheat
3rd year—paddy or gram
4th year—Green manuring.

We saw their bullocks. They were of Hariana, Kheri, Sitamarhi and Purbi breeds.

The afternoon programme was to see the Agricultural School. There was nothing special there.

Next day, on the 8th of January we went to Kasia, the place where the great Buddha had passed off or attained Nirvana. We saw the grand golden tomb—Parinirvana stupa and Buddha's statue, 20 feet long, lying in the place where he died.

In the evening we left Gorakhpur for Mankapur where we reached at midnight. The next morning on the 9th January at about 8 o'clock we started for Ayodhya. Once more, we had a jolly day journey on the train. The crops we saw on both sides were not so very rich as those on the way to Pusa. It was all U. P. like. The lands were brown and the grass was reddish. There were many trees but we did not know the names of many of them. We reached Lakarmandi Ghat at about 10-30 a.m. Here we had to get down from the train and cross the river Saryu with its broad, sandy bed before we reached Ayodhya.

We saw the various places of historical importance at Ayodhya until evening on *tongas* and then went to Fyazabad. We got accommodation in the Intermediate College Hostel. It was night when we arrived,—the last night of our trip.

Next morning on the 10th of January at about 8 a.m. we went on *tongas* to the Government Farm. We were very pleased and satisfied to see this farm for we learnt a great deal here. In this farm they are trying their best to cut down the expenses of production, especially of the sugarcane crop and to reduce them to a minimum so as to get the highest profit. They have got the cooperation of the poor village farmers and are able to help them with their knowledge. Besides, this farm is the centre of the Colonization Scheme of the U. P. Government. This scheme is to help the students to start a life of farming.

We saw the various experimental plots in the farm. They were carrying on experiments to compare the yield of four different varieties of groundnuts—Big Japan, Small Japan, Spanish and Okola No. 10. Big Japan has so far given the highest yield—22 maunds.

They had four varieties of Arhar growing—Sabor erect No. 2, Sabor spreading No. 7, Pusa 24, and a local variety.

(*Continued on page 75.*)

NEW TRACTION DYNAMOMETER AND CAR.

By Mason Vaugh B. Sc., A. E.

Agricultural Engineer, Allahabad Agricultural Institute.

The Agricultural Engineering Department of the Allahabad Agricultural Institute has just completed the construction of a traction dynamometer for draft studies and a loading car to be used with it in testing the strength of animals. This provides a long-needed facility for carrying on research and for teaching demonstrations.

The dynamometer is built to plans originally worked out by the Department of Agricultural Engineering, Michigan State College of Agriculture, Lansing, Michigan, U. S. A. It consists essentially of a pressure cylinder actuated by levers to convert tension pull into compression, and a clock-driven recording pressure gauge. The pressure gauge is provided with two separate Borden type coils of 250 and 500 lbs. pressure maximum capacity. Two cylinders are provided with areas of 2·5 and 5 sq. inches respectively. Lever arms may be supplied to suit the work in hand. At present, one set with suitable holes gives ratios of 1 to 1, 2 to 3 and 3 to 2, which will be sufficient when used in connection with the smaller cylinder to cover practically all work with bullocks. The pressure is transferred from the cylinder to the gauge by oil through a copper pipe of $\frac{1}{4}''$ diameter. A flexible pipe would be much better if available but so far none has been secured. The copper pipe works satisfactorily.

Calibration of the dynamometer was carried out by swinging it between two steel columns by iron chains. A spring balance of 500 lbs. capacity is used to measure the pull which is exerted through an ordinary chain block. The capacity to be tested in this way is of course limited to the capacity of the scale but with the lever arms provided, this will cover the whole range of power which can be developed by one pair of bullocks.

In addition to teaching demonstrations, the dynamometer can be used to investigate all sorts of problems of the power required to work implements, the influence of design on the power required in working implements and generally all problems of draft with either bullocks or tractor power in traction.

For use with this dynamometer, a loading car has been made. It is based on an old Austin tractor, which has been arranged so that a varying load can be imposed on animals hitched to it. The cylinder block, fuel tank and radiator were removed as well as the fly wheel and clutch and crank shaft. The crank case was left as it forms part of the frame of the tractor. Fortunately, the tractor was originally equipped with brakes of the expanding type on both back wheels. These were originally

operated by individual levers. An equalising system was arranged so that both brakes can be applied with one lever. If it had not had these brakes already, the fitting of a brake drum to either the pulley shaft or to the main drive shaft would have been quite simple and may be resorted to if at some time in the future it is used for testing power units beyond its present capacity. The addition of a place to hitch the bullocks in front completed the car.

This car is to be used for research on the pulling power of bullocks. At present we have in mind two problems, the hitching by various types of harness and yokes and the much larger problem of the study of effect of conformation on the power it is possible for an animal to exert. We have reason to believe that the power available for work from the average pair of bullocks can be considerably increased by better yoking or harnessing. This car and dynamometer used together will enable us to actually test the effect of changes in such harnessing. Much work is being done at present in India on cattle breeding with the avowed purpose of developing good work animals from the males and good milk animals from the females. We have fairly well established knowledge as to what constitutes a good milk animal conformation but we have so far been able to find no record of any systematic study of what conformation is best for draft animals. Of course, breeders and users have ideas about what constitute a good draft bullock but they are not based on real tests. We hope that this equipment will make available scientific data for the guidance of breeders. The engineering department would welcome correspondence with anyone interested in the problem, especially with reference to work already done along these lines, either with bullocks or horses.

(Continued from page 73.)

We were told that sugarcane, wheat and gram were the main crops of the farm and the system of rotation was :—

1st year—Sugarcane.
2nd year—Wheat.
3rd year—Gram.

We saw a Persian wheel being worked by a camel. It was for experiment. Then we saw the colonization equipment there—the common room, library, kitchens, guest-house, barns and the private rooms for the colonizers.

It was afternoon when we returned from the farm. We were to catch the train for Allahabad at about 3·30 p.m. Some of us went to the city to take our meals and to see the places of historical interest there, such as the Gulabbari and the Begum's tomb.

At about 3·30 we left Fyzabad for Allahabad. We reached Allahabad at about 8 p.m. the same day.

SPRAYING

By Prof. W. K. Wesley, Department of Zoology, and
G. Q. Vachoo, Asst. to the Farm Manager.

Spraying is an important operation for controlling or preventing insect pests, fungal and bacterial diseases. This operation is performed when the attack is going on.

The importance of this method of control can be only realized when we consider the enormous power of reproduction in the case of some insects doing damage to our valuable fruits and fruit trees. It has been calculated in the case of San Jose Scale (Aspidiotus sp.) that a single female may produce 400 young ones in 14 days. As the life cycle of the female is completed in a very short time, there are many successive broods of females in a year. The progeny from a couple during one season has been estimated to be 160,804,240, which gives us some idea of the rapid multiplication in the case of some insects and the need of controlling them by such devices as spraying, fumigation, etc.

For control purposes insects may be placed into two main groups, *viz.*

1. Insects with biting and chewing type of mouth parts (Mandibulate type) and

2. Insects with sucking and siphoning type of mouth parts (Haustellate type).

"Insects which feed by eating the leaves of plants may be controlled by spraying the leaves with a stomach poison which consists of some material poisonous to insects, mixed with sufficient quantity of water. It is applied by means of a spraying machine, which forces the liquid mixture through a pipe, ending in a special nozzle which breaks the liquid into a cloud of spray. This spray is directed to the leaves and just so much is applied as is necessary to cover the leaves with a thin layer of the poison. If too much is applied, the liquid will form drops and run off the leaves, which should be avoided.

Spraying with the stomach poison should not be done when the leaves are wet or in a heavy wind or in hot sun. If any wind is blowing the spraying should not be done against the wind.

Insects which obtain their food by pushing their heads into the plants and sucking the sap cannot be destroyed by stomach poisons. For these and for small caterpillars a contact poison is effective.

Contact poisons operate through the skin or the breathing holes (spiracles) of the insects. It is therefore necessary that the insects should be wetted with the poison. This is done by spraying

the mixture through a spraying machine on to the parts of the plants where the insects are feeding. It is necessary to make sure that all the insects have been thoroughly wetted. Contact poisons should, therefore, be applied until the attacked parts of the tree are dripping wet." Richards, P. B. and Sharma, H. N. "The Damage caused by Insects on some commonly grown fruits in the plains of the United Provinces." Control methods and materials. Bulletin No. 3. (Fruit Seris) pp. 13-15.

The spraying fluids (Insecticides) may act as preventives or curatives. The selection of the fluid depends upon the kind of pest we are dealing with and the nature of the plant treated.

In order to get the most out of vegetables and fruits we ought to keep them as much disease free as possible. Much can be achieved in this direction through spraying rightly and at the proper time.

For the application of these fluids a spraying machine is required which breaks up the liquid into a fine spray.

In order to be effective the spraying should be thorough and application liberal. Fine weather is also necessary for successful spraying. Spraying during rains will be a waste of insecticide as it will be soon washed away. It is also not advisable to spray plants or trees during the middle of the day as it may result in the scorching of the leaves, or during a strong wind, as much of the insecticide will be wasted, or when the trees or plants are in bloom, as much damage will be done to the reproductive organs and a good crop cannot be expected.

Below are given some of the insecticides with their preparations and uses which have been tried in several places and are proved to be very effective in checking some insect pests :

Lead arsenate (paste or powder)

Formula—

	Lead arsenate paste	... 2½ seers
Or	Lead arsenate powder	... 1 seer
	Gur or molassses	... 3 seers
	Lime	... 1½ seers
	Water	about 45 seers (10 gallons)

Preparation.—Dissolve the gur in a little hot water. Work up the lead arsenate paste or powder to a thin cream in a small quantity of water with a wooden stick, and mix them together. Slake the lime and make it into a paste. Mix this up with the previous preparation and add the rest of the water. Stir well. Keep the mixture well stirred during use to get an even distribution of the poison. The attacked plants are sprayed with the mixture,

care being taken just to wet the surface uniformly. Drenching the plants is to be avoided, because it involves an unnecessary waste and an excessive use of the poison.

Lead arsenate is a white virulent stomach poison. It is very good against caterpillars, sawfly larvae, beetles and their grubs, grasshoppers, locusts and their nymphs.

Every care should be taken in the use of this poison. Even in small doses it is fatal to the cattle and man. No cattle should be allowed to graze on the plants treated with this insecticide. It should not be sprayed on vegetables, fruits and fodder crops which are to be consumed shortly after the treatment, Vessels in which the insecticide is prepared should be thoroughly cleaned.

Paris Green

Formula—

Paris green ...	...	$\frac{1}{4}$ seer
Lime ...	...	$\frac{1}{2}$ seer
Water ...	...	225 seers (50 gallons)

Slake $\frac{1}{2}$ seer of lime with a little water and then add 222 seers of water to work it up into a solution. With about $2\frac{1}{2}$ seers of water work up $\frac{1}{4}$ seer of paris green into a thin cream. Mix the lime solution with the paris green cream and stir well. This mixture should be kept stirred during spraying to get an even distribution of the poison.

Every precaution taken in the case of lead arsenate should be followed with paris green also. It is a stomach poison and is very effective against the caterpillars of butterflies, orange-red pumpkin beetles and nymphs of grasshoppers and locusts. It should be sprayed on the plants so soon as the pests appear.

(*To be Continued*)

Spleens from Rinderpest Virus producers of about two years of age were taken out and the capsules were removed. The spleen pulp was minced in an ordinary meat mincer and was afterward placed in flasks containing normal saline in the proportion of one gramme of spleen to 4 c.c. of saline. To this mixture was added 4 parts of commercial formalin to every 1000 parts of the mixture. This was then well shaken up and left for 48 hours at room temperature. It was used between 48 hours and 7 days and found to be efficacious in doses of 25 c.c. of the mixture, inoculation subcutaneously. Immunity was established within ten days of inoculation. It is a vaccination as a preventive and not a curative.

Lingnan Science Journal.

ALKALI SOILS

By S. C. Chowdhury

Continued from last issue

Alkali Soils in Relation to Plants

In this part of our paper we shall discuss the relation between alkali and plant growth. The subjects to be considered in this connection are:—

(1) Factors controlling the action of alkali on plants.

(2) The relative tolerance for alkali of the important crop plants.

(3) Possibility of increasing the tolerance of plants.

(4) The value of natural vegetation as an indicator of Alkali in the soil.

Factors controlling the action of alkali on plants

It is impossible to discuss intelligently the effect of alkali on plants without taking into consideration a number of controlling factors. The most important of these are:—

(1) The chemical composition of the alkali, *i.e.* the kind of salts and the proportion in which each is represented.

(2) The distribution of the alkali in different depths of the soil.

(3) The rooting habit of the plant, whether shallow or deep.

(4) The texture of the soil.

(5) The water content of the soil and its fluctuations during the growth of the plant.

(6) The physiological constitution of the plant, which largely determines its power of resisting alkali, some species being constitutionally more tolerant than others, although nothing in their obvious structure may account for their greater resisting power.

(7) Indirect action by affecting the development of associated organisms, both beneficial and harmful.

The chemical composition of the alkali.—The salts which make up the bulk of the so-called "alkali" are pretty much the same the world over. They are the chlorides, sulphates, carbonates and bicarbonates, often with smaller quantities of the nitrates and phosphates af the alkali and alkali earths, especially sodium, potassium, calcium and magnesium. Of these sodium, chloride and sodium sulphate are the most abundant. In different localities and

often in the same field within distances of a few feet, great differences can be detected in the kinds and relative proportions of the salts present. On the other hand, a whole region is sometimes characterised by the predominance of some one salt or combination of salts.

The alkali of the soil is practically always a mixture of several salts, and for this reason the great differences in the degree of harmfulness of the various salts that manifest themselves when each salt is present alone in a water solution are not usually observed in the soil. A notable exception is sodium carbonate, which, if present in quantity, is easily recognised by its disastrous effect on vegetation. It is the so-called "black-alkali" and, unlike the sulphates and chlorides which are collectively known as "white alkali," is a true alkali in the chemical sense, turning red litmus paper blue. It is most easily identified when it occurs in moist places, where by its corrosive action on organic matter it stains the surface of the soil dark brown or black, and gives to standing water the colour of strong coffee. In contact with the roots and crown of a plant it corrodes the tissues and, if sufficiently concentrated, will fairly girdle the base of a tree by eating into the bark. The effect of the girdling is soon manifested in the yellowing and premature dropping of the leaves. Because of the very violence with which "black alkali" attacks plants, their limits of tolerance for it are usually more sharply defined and more easily ascertainable than in the case of white alkali.

Sodium carbonate is said to be three to four times as harmful in the soil as sodium chloride. The consensus of opinion is that an amount of carbonates equal to one-tenth of one per cent of the dry weight of the soil will prevent the germination or kill the seedlings of most of the common crop plants and that one-twentieth of one per cent is often enough materially to injure the crop. Jensen observed fruit trees in Washington that had been killed by 0·1 per cent of alkali in the first three feet of the soil, 0·15 per cent in the surface foot when the bulk of the salts was sodium carbonate. Loughridge found orange trees in Southern California slightly injured by as small a quantity as 0·025 per cent of sodium carbonate in the first three feet, where that salt formed a large part of the total alkali. It is rarely found that crops can thrive in the presence of one per cent total alkali salts, especially if the more harmful sodium chlorides and carbonates predominate. Studying three sodium salts separately in sand, Harris found 1000 parts per million of sodium chloride or sodium carbonate, the approximate toxic limit to wheat seedlings in sand whereas in the same soil the wheat seedlings could endure 5,000 parts per million of sodium sulphate. These toxic limits were greatly increased with increase in moisture content, reaching 5,700

parts per million sodium chloride with 18 per cent moisture, 3,300 parts per million sodium carbonate with 21 per cent moisture and 16,000 parts per million sodium sulphate with 24 per cent moisture. The California Experiment Station has made the interesting observation that small seeds, like those of alfalfa and the meadow grasses, are more easily destroyed by black alkali than larger seeds, like maize and beans.

The distribution of alkali in different depths of the soil.— To say that a given soil contains a certain percentage of alkali means nothing, unless we know how this amount is distributed at different depths in different seasons of the year and different stages of plant growth. If at the time a crop of alfalfa or barley is planted, a large part of the alkali is accumulated, at or near the surface, it will be almost impossible to get a stand unless the seed is put in deep, or unless by irrigating heavily before seeding the excess of salts is washed out of the surface. If a good stand is thus secured, it will itself keep down surface accumulation by shading the ground and thus reducing evaporation from the soil. If the land is then occasionally flooded, no danger is usually to be apprehended during the life of the crop. In the case of crops like sugar, beets and garden vegetables which leave much of the soil unshaded, the return of the alkali can be prevented by frequent cultivation, which effectively cuts down the evaporation by maintaining a dry mulch on the surface.

In alkali soils the period of germination and of the first two or three weeks growth is the critical one for most plants. This is perhaps due not so much to the young plants being constutionally more sensitive than older ones, as to the fact that roots have not yet had time to penetrate below the first few inches of soil, where a large part of the alkali is often accumulated in the form of a crust.

The great importance of vertical distribution as determining the soil for crop production is shown by the fact that a fine crop of barley was observed by Mesmer in soils containing three per cent of alkali, chiefly sulphates in six feet, the bulk of the salts being found in the lower three feet, while in other places 0·2 to 0·4 per cent of alkali in six feet was enough to prevent growth, having been mostly accumulated near the surface at the time the barley was seeded.

The rooting habit of the plant :—After the seeding stage is passed, it depends largely on the character of the root system as to how the plant is affected by the amount and distribution of alkali in the soil. A shallow-rooted cereal, for example, is much more likely to be injured by an accumulation of salts near the surface than is a plant like alfalfa, the roots of which soon find their way

into lower depths of the soil. On the other hand, the deep rooted crop may be injured by deposits of alkali lying below the first one or two feet that would in no way harm a crop of wheat or barley, unless subsequently brought up by the rise of the water-table.

Fruit trees are often observed to fail suddenly in land in which they have grown vigorously for several years, either because their roots have at last reached a deep-lying layer of alkali or because a gradual rising of the water-table has brought the salts up to the roots. It is not improbable that in some cases deep-rooted plants will tolerate a greater amount of alkali if situated in strata of soil alternating with zones that are relatively free from salts, than a smaller amount more uniformly distributed, for they will be able to develop the greater part of their root system in strata containing little alkali and can thus support the injury suffered by their lateral roots where the alkali is stronger. The date palm is said to be a case in point.

Texture of the soil :—The harmfulness of a given percentage of alkali also depends largely on the texture of the soil. A fine-grained clay or loam not only has a much greater water capacity than a coarse sand, but, its absorptive powers being greater, much more of the salt is withdrawn from the capillary spaces. Thus in Utah, Sancher found that in a heavy loam sugar beets grew well in the presence of 1·5 per cent. of alkali in the first six feet while in a soil of coarse sandy texture they were injured by 0·65 per cent. in the first foot, with successively smaller percentages of salts down to the sixth foot.

Moisture content of the soil :—The fluctuations in the moisture content of a soil are of great importance in determining the harmfulness of the alkali it contains. The salts in the soil can affect the plant, either beneficially or harmfully, only when dissolved in water. The greater the water content of a soil the more dilute will be the solution, supposing the total amount of salts present to remain constant. Thus, if the alkali amounts to one per cent. of the dry weight of the soil, the solution will be twice as concentrated and twice as injurious to plants when the soil holds 10 per cent of moisture as when it holds 20 per cent. Hence, a crop is sometimes found to thrive in one soil and to perish in another, the percentage of alkali and the texture of the soil in each case being the same, because in the first a high moisture content has been maintained throughout the growing season while the second soil has been allowed to dry out at intervals.

Relative tolerance of the important crop plants :—In considering the value of a crop plant for alkali soils, we must take into account not only the ability of the plant itself to grow in the presence of a certain amount of salts, but also the effect of the

alkali on the quantity and quality of the product, whether seed, fruit, fibre or sugar. The California Experiment Station has stated that no decrease in the value of grapes for wine-making purposes could be detected in soils that did not contain enough alkali noticeably to injure the vines themselves. On the other hand, the same station has found pear trees growing vigorously in soils where they could produce only poor or worthless fruit. Kearney has found alfalfa plants making a fair growth where there was too much alkali for the production of good seed; cotton plants doing well where the length and quality of their fibre was decidedly inferior; and beet plants with healthy looking tops, although the roots were much smaller and the sugar content much lower than in other parts of the same field where less alkali occurred. It is thought by many that an amount of alkali too small to be injurious is sometimes beneficial rather than neutral, *e.g.*, by stimulating sugar production in beets and cane, improving the strength and colour of cotton fibres, giving wine grapes a desirable degree of acidity and the like.

(1) Cereal.

Barley, wheat, oats and rice are the only cereals that can be extensively grown in alkali soils. These cereal crops have been found to yield a normal harvest with 0·20 per cent. of alkali salts in the soil. Of these cereals, barley is generally regarded as the most resistant; but in North Dakota, where sulphates form most of the alkali, Jensen found oats more resistant. Examining only the first foot of the soil, he found that: barley in 0·40 per cent. gave a good crop, in ·70 per cent. a poor crop; wheat in 0·45 per cent. gave a good crop, in 0·5 per cent. was killed; oats in 0·50 per cent. gave a good crop, in 0·60 per cent. a fair crop, in 0·80 per cent a poor crop. A fair crop of barley can generally be obtained in soils containing 0·4 to 0·6 per cent. of "white alkali" if well distributed in the first six feet of the soil. Under the same conditions, a fair stand can sometimes be obtained in 0·6 to 1 per cent. of alkali. When much sodium carbonate is present, the limit is of course lower; but the California Experiment Station considers barley twice as resistant as wheat to "black alkali."

When the bulk of the alkali is sodium chloride or sodium sulphate, 0·4 per cent. of the total salts in the first six feet seems to be about the limit for a good growth of wheat. The "durum" or "macaroni" wheats are considered more resistant than soft wheats. In Utah, oats gave a fair stand when the alkali (mostly sodium chloride) amounted to 0·4 per cent. in the first three feet of the soil, while they failed in 0·7 per cent. chiefly held in the second foot. Berthault and Paturel from Algeria report that cereal crops

yield a normal harvest with 0·2 per cent. alkali in the soil. Hilgard reports that a soil containing 1·381 per cent. of alkali in the first three inches and 0·513 per cent in the first foot has given a good stand and yield of barley. The California Experiment Station has reported rye to be about as resistant as barley, while in Southern Arizona, where, however, it is little grown, it is said to be much less resistant. Maize is little grown in alkali soils either in the United States or in India. In Egypt it is said to fail on land that is not too salty to yield good crops of rice and cotton. Rice as it is grown in standing water has been found to withstand high concentrations of alkalis in the soil. Professor Knight reports 80 per cent. of a full crop to a full crop of rice from the alkali soils of the konkan.

(2) Forage Crops.

(*a*) *Grasses* :—Of the cultivated grasses, timothy appears to be the most resistant, growing well in Montana in soils containing 0·9 per cent. of total salts, largely sodium sulphate, in the first six feet. The Australian salt bush Atriplex semibaccatum is capable of growing with vigour on almost the worst forms of alkali land. An analysis made by Jaffar showed the dry matter of the plant to contain 20 84 per cent. of ash about 40 per cent. of which was sodium chloride. A crop of 5 tons of dry salt bush fodder was found to remove 1,360 lbs. of alkali salts from the soil. Smooth brome, red-top and perennial ryegrass seem also to be rather tolerant of alkali. Some of the less valuable meadow grasses of America, however, such as salt grass and tussock grass, are found to be exceedingly resistant. In North Dakota, where the alkali is generally of the sulphate type, good meadows of native grasses have been observed where there was 1 to 1·5 per cent. of total salts in the surface foot of the soil. Grass was found growing knee-high where there was over 1 per cent. of salts uniformly distributed through the first three feet of the soil. In the Oregon Experiments Station Fall rye has proved the easiest to establish in black alkali soils and has given fair yields of rye hay. Blue grass, meadow fescue, red top, timothy and a native slough grass—Echinochloa crusgalli—have been grown successfully in the alkali soils of Oregon.

(*b*) *Jowar*.—In California, jowar has been observed to grow well when the surface foot of the soil contained 0·9 per cent. of alkali mostly sulphates and when the first four feet held 0·5 per cent. (about one-half carbonates, the remainder largely sulphates). When the alkali is mostly sulphates or chlorides, a fair stand can often be secured when there is 0·6 per cent. to 1 per cent. in the first six feet of the soil.

(3) *Legumes.*—Most leguminous crops are sensitive to alkali. Alfalfa, the only plant of this class that is extensively grown in regions where alkali soils occur, appears to be one of the most resistant, but probably this is largely due to the fact that its roots soon penetrate below the layers of soil where most of the Alkali has accumulated. Of other leguminous plants tested by the california Experiment Station *Vicia Villosa* has been found to be the most tolerant of "White Alkali," giving a fair stand where there was nearly 0·5 per cent. of alkali in the first 4 feet but *Medicago Maculata* was the most resistant to black alkali. Opinions differ as to the ability of *Melilotus alba* to endure much alkali, in Utah it is said to grow well even when the total salts, chief by sodium chloride, amount to 1 per cent in the first five feet in the Oregon experiment station it has been found the most effective in improving the soil condition. It stands a great deal of alkali and thrives well when once well established but is sensitive to alkali when young.

A stand of a alfalfa can often be obtained in soils containing a very large total amount of alkali in lower depths, if the few inches of the surface soil are practically free from alkali at the time of seeding. But if the distribution is fairly uniform 0·1 per cent. of "white alkali" in the upper six feet of the soil appears to be generally about the limit for a successful seeding. Alfalfa, especially, in the first stages of growth, is peculiarly sensitive to "black alkali." As much as 0·7 per cent. of alkali, chiefly sulphates, in the first 4 ft. of the soil may not injure well established alfalfa. But when the moisture content fluctuates greatly during the growing season, even less than 0·6 per cent. can seriously injure old stands.

Professor Knight made some experiments with *cicer arietinum*, *Dolichos lablab*, *Vigna catjang*, Phaseolus radiatus and *Lathyrus sativus* on a plot fairly seriously affected with alkali salts in Baramati, India. Previous to the planting of these crops, the land was planted to rice and drained with deep open drains on all four sides. The amount of salt in the soil of the land was remarkably even as will be evident from the following table.

The samples of the soil were from the surface to 4″ deep the subsoil represented a section from 4″ to 9″ deep in each case.

Table IV.

Composition of the alkali salts, (Baramati), Knight.

	Phaseolus Radiatus	Vigna catjang strip.		Dolichos lablab strip.		Oicer arietinnm strip.	
	Soil per cent.	Soil per cent.	Sub-soil per cent.	Soil per cent	Sub-soil per cent	Soil per cent.	Sub-soil per cent.
Total Salts in dry soil ..	0·476	0.446	0·206	0·420	0·998	0 420	0·332
Ca Carbonate ..	7·14	5·83	12·62	4·76	0·50	5·24	6 63
Na „ ..	1·05	1·12	0 97	5·00	1·41	1·19	1·51
Ca. sulphate	11 56	36·55	33·00	3·33	3·42	30·70	14·45
Mg „	11·14	27·80	28·65	9·53	3 52	15·24	1·21
Na „	65·96	21·52	8 74	57·86	10 05	20·49	49·09
Na Chloride	3·15	7·18	16·02	19 52	81·10	27·14	27·11

Lathyrus sativus germinated well, but was rapidly injured, and as a crop uniformly failed. Phaseolus radiatus also germinated well, but was rapidly injured and became unsatisfactory over the greater part of the field. The roots only penetrated to a depth of 4 inches, and no nodules were found on them whatever. Vigna catjang was much better than Phaseolus radiatus and Lathyrus sativus, and gave a very fair yield throughout. The yield was 800 lbs. per acre. The plants were practically all healthy and the roots penetrated usually to a depth of 9 inches with a limited number of root nodules. In one case the roots were found to go to a depth of 14 inches. Dolichos lablab, in appearance was the best crop of all those that were tried. A few plants only were slightly damaged and the actual yield per acre was 740 lbs. of grain. Very few root nodules were found. The roots penetrated to a depth of 10 inches. Grain, though germinated successfully gave a poor crop, more especially in patches. No nodules were found on any of the roots, not even on the large good plants ; few if any roots went deeper than 6 inches. The crop was very poor.

Of the common leguminous crops grown in the country Dolichos lablab, vigna catiang, vicia villosa, melilotus alba, medicago maculata and alfalfa seem to be the most resistant to alkali salts.

(4) *Sugar crops:* In the Nira Valley, India, it has been found that of all the crops grown sugarcane seems least injured, provided that a sufficient amount of irrigation water and organic manures be used. With a soil containing 0·8 per cent. of soluble alkali salts the cultivators have obtained an yield of 12,500 lbs. of "gul" per acre with the application of 75,000 lbs. of cattle

manure and 4500 lbs of oilcake. But sugar-beets have been found more tolerant to alkali salts than sugarcane and most other crops. They can germinate and pass the seedling stage in the presence of one per cent. of "white alkali." They will almost always make a good growth when there is 0·6 per cent. of alkali in the first six feet, if chiefly chlorides or sulphates, and frequently when there is one per cent. Hilgard and Loughridge after extensive experiments at the California Experiment station conclude that beets of good quality and purity can be grown on lands containing 12,000 lbs per acre of alkali salts in 3 ft. of the surface soil, provided sodium chloride does not exceed 1,500 lbs. per acre. They consider sodium chloride more injurious to beet than sodium carbonate, but beets seem to be more tolerant of "black alkali" than most other crops. Even if a good stand can be obtained, it is probably not advisable, as a rule to grow beets when the soil contains more than 0·6 to 1 per cent. in the first six feet, for when greater amount of salts are present the roots are small their keeping quality is poor and their sugar content and purity are much impaired.

(5) *Textile crops.* In western Texas, where upland varieties are grown, cotton is said to be the most alkali resistant crop of the region. Both in Egypt and Arizona a fair quality of fibre is produced by Egyptian varieties in the presence of 1 per cent. of alkali salts, mostly sodium chloride in the first two or three feet of the soil. In some alkali regions of India cotton has been successfully cultivated but no specific data are available as to the amount and nature of alkali salts in the soil, the stand of the crop and the fibre-yield. F'lax in North Dakota was observed by Jensen to suffer most where the alkali was accumulated in the surface foot. The presence of 0.8 per cent. of alkali salts in the first foot killed the plants.

(6) *Tobacco :* No attempt has been made uptil now to grow this crop in an alkali soil. But a study of plant physiology reveals that this plant is capable of tolerating a relatively high percentage of soluble salts in the soil. As its combustibility is impaired by excessive salts in the soil, tobacco should not on any account be grown in alkali soils.

(7) *Garden Vegetables* : Asparagus seems to be first among garden vegetables in its tolerance of alkali. In California Means and Holmes have found that it grows well in 0·6 per cent. of alkali salts, if mostly sulphates and chlorides, in the first 5 ft. of the soil. However it is said to be sensitive to "black alkali". Beets, onions and garlics are said to grow well where the first 5 ft. of the soil contain 0·4 to 0·6 per cent of alkali salts. Potato plants are apparently very resistant and will grow where the surface foot of

the soil contains nearly 0·5 per cent of "white alkali," although the tubers produced are watery and do not keep well. Globe artichokes are among the most tolerant of garden vegetables. Some of the more sensitive vegetables are beans of all kinds, peas, celery, and with a few possible exceptions, the cucurbit—squashes, cucumbers, melons and the like.

(8) *Trees.*—It is exceedingly difficult to determine the alkali resistance of trees. The vertical distribution of the salts in the soil cannot be overlooked because of the great differences in the root systems of different plant species. The thickness of the bark of the crown largely determines the amount of injury to be apprehended from 'black alkali.' Most fruit trees are easily injured by standing water, and as the water table is usually high in alkali soils it is often hard to decide whether it is the water or the alkali that is doing the harm. So far as the present data go, the order of tolerance of the fruit trees is about as follows, beginning with the most tolerant: date palm, pomegranate, pear, quince, olive, fig, apple, almond, peach, plum, orange and lemon. The English walnut also has a great aversion to alkali.

(9) *Vines.*—In a report of the salt lands of Habra in Algeria, Berthault and Paturel state that the cultivation of the vine is not hindered by the presence of 0·06 per cent of alkali salts in the soil. When the amount reaches 0·08 per cent in the surface soil, and 0·27 per cent in the subsoil, the vine languishes, and becomes unprofitable. With 0·17 per cent in the surface soil, and 0·37 per cent in the subsoil, the vine dies. According to the California Experiment station the greatest amount of tatal salts in the first three feet of soil in which grapevines were found to show no sign of injury was 0·3 per cent, of which one-fifth was carbonates. When the total alkali was 0·5 to 0·6 per cent in the upper three feet of the soil and carbonates formed one-half of it, the vines were killed.

Increasing the Tolerance of Crop Plants for Alkali.—Uptil now very little effort has been made to increase the tolerance of crop plants for alkali. The possibilities of increasing the tolerance of crop plants for alkali has not been as yet fully realised. The breeder's efforts are now concerned with the problems of quality, the power of plants to resist fungus and insect attack, and the adaptation of crops to different climatic condition. He will have now to face the problem of synthesizing new breeds and strains of plants capable of cultivation in localities where there is a large accumulation of Salts at the surface.

Two methods suggest themselves for increasing the alkali resistance of crop plants. One is the introduction from other countries of strains or races of plants that have become adapted to

alkali soils during the centuries they have been grown on them. Much has already been accomplished along this line by the United States Department of Agriculture, which has imported various durum or macaroni wheats, strains of alfalfa from central Asia and northern Africa, and numerous varieties of the date palm. In India no effort has been made in this line.

The second method for increasing alkali resistance is by breeding, *i.e.*, by selection practiced with that end definitely in view. Near the margin of the bare spots that often occur where a crop is growing in an alkali soil, we often find scattered plants that are barely able to survive and to mature seed. Examination of soil around such plants generally shows them to be exposed to more alkali than average individuals of the species or variety can endure. Many examples could be given. While 0·6 per cent. of total salts is often the limit of tolerance for barley, a few plants have been observed to head out in the presence of nearly 1 per cent. mostly chlorides, in each of the first three feet of the soil. Sugar-beets rarely give a good stand where there is more than 1 per cent. of alkali ; yet occasional beets of fair size, having a sugar content of 12 per cent. have been found where the first two feet of the soil contained 2 per cent. Well established stands of alfalfa are often injured by 0·5 to 0·6 per cent. of "white alkali", yet resistant plants can ripen seed when the first two feet of the soil hold 1·5 per cent. or even 2 per cent. of alkali salts. By saving seed from such plants for a number of generations, it is thought that alkali, resistant strains of the more important, crop plants can be secured. Deterioration in other respects must, however, be guarded against.

The Value of Natural Vegetation as an Indicator of Alkali.— Land which is affected with alkali salts quickly becomes barren, if dry. On land moderately affected by alkali it is possible to start the growth of crops at the close of the wet season. The crop at first grows with great luxuriance, but as summer advances saline matter accumulates at the surface, and the crop withers or yields but a small produce. When the amount of alkali is still greater, the seed sown will rot instead of germinating. In the worst cases even the natural weeds cease to grow, and the land becomes bare. If the quantity of salt be small, then dwarf *Acacia arabia* establish themselves and the common *Cassia auriculata* is also very frequent. The samphires, or pickle weeds, and the bushy samphire or kern grease-wood (*Allenrolfea occidentalis*), appear almost always to indicate that there is 1 per cent. or more of total salts in the first few feet of the soil. But the majority of alkali weeds have a very wide range of adaptability, growing in soils that are practically free from alkali as well as in soils that contain so much as to be unfit for any crop. Such are the salt worts and the well known salt grass,—*distichlis spicata.* When *cyperus rotundus*

and *Andropogan intermedius* are not found growing it should be taken for granted that the land is absolutely barren.

Moreover, some plants are so averse to alkali that their absence in a piece of land, otherwise adapted to them by the texture and moisture content of the soil, is the safest of all indications that it contains a dangerous amount of alkali. Such negative indicators are the *Artemisia tridentata* and the "creosote bush."

In considering the value of plants as indicators, it must be remembered that no species is everywhere associated with a fixed, percentage of alkali. The different kinds of salts and the proportions in which they occur, their distribution in different depths of the soil, the moisture content and its fluctuations, the texture of the soil and, finally, the climatic conditions are all expressed by the character of the natural vegetation. But the cultivated crop is no less an expression of the combined influence of these factors. The natural vegetation on a particular soil is the best guide to its agricultural possibilities.

[The last article by the same writer on "Reclamation of alkali soils" will appear in the next issue—EDITOR B. M. P.]

MALAYAN FODDERS

A small bulletin which may be of interest to animal husbandrymen in India has recently been issued by the Department of Agriculture, Straits Settlements and Federated Malay States. In recent years it has been realized that the feeding of animals is a process which requires knowledge and skill for its successful practice. Rule of thumb methods which previously prevailed have been replaced by the computation of rations on a scientific basis. The principles underlying feeding are now well understood, and it is possible by varying the ingredients of an animals's food to fit it with considerable exactness to the duty which it is required to perform.

Information on the subject is however not always available to the agriculturalist. In this small Bulletin the general principles involved are described and supplemented by analytical data concerning the composition of foodstuffs which are ordinarily employed in that country. Since many of these are similar to foodstuffs used in many parts of India, it may be of considerable interest to Indian agriculturalists who are trying to feed their animals on a scientific basis.

The bulletin is:—"Fodder and Feeding stuffs in Malaya" by C. D. V. Georgi, Department of Agriculture, S. S. and F. M. S., Special Bulletin, General Series, No. 17,—1934. Price 50 cents (Straits currency). It may be had, by remitting the price to the Director of Agriculture, Kuala Lumpur, Federated Malay States.

Norwegian experiments show that if hay is dried rapidly, it retains best the Vitamins A and D, needed by cattle.

THE PRINCIPLES OF MAKING JELLY

By A. D. Chand.

Jelly making is both a science and an art. It is a science because it makes use of abstract principles. It is an art because it requires a sound skill guided by definite rules. In order to manufacture good jelly successfully one must understand its science and acquire a thorough skill. The art or skill may alone enable a man to manufacture jellies successfully but this would be only possible if he follows a set of definite rules which he has drawn up with his personal experience after a great deal of laborious experiments. This certainly would involve him in a good deal of loss in the beginning as long as he has not reached to certain particular conclusions; but if he knows the science of jelly making, he will attain his end earlier, without undergoing too much loss.

For the benefit of those who are interested in making jelly or its allied products, either for home use or for commercial purposes, the science and art of manufacturing these products will be concisely discussed to equip them with a basic knowledge and fundamental principles involved in making these products.

Before going into the detailed discussion of principles, an amateur would like to know what jelly is. Because many persons do not have the exact conception of jelly it is therefore necessary to state clearly at the outset as to what we are talking about.

Definition.—Jelly is a product obtained by boiling fruit with or without water, extracting and straining the juice, adding sugar and cooking it to such a consistency that gelatinization should take place on cooling. A perfect jelly is clear, sparkling, transparent, and of appealing flavour and attractive colour. When poured out from the container it should retain its form, quiver, but not flow. It should neither be syrupy, cloudy, nor gummy or sticky and should possess the aroma of the original fruit. It should be firm and should cut with a sharp, sparkling edge and should retain its firmness even after cutting.

In order to produce jelly, there are three most essential ingredients that are required to make jelly and these are (1) acid (2) pectin and (3) sugar.

This brings us to the fact that in order to produce good jelly one should have a thorough knowledge of the composition of fruit or should possess a knowledge of testing fruit juice, whether they contain these ingredients or not.

Acid.—Fruits vary a great deal in their acid content, some fruits like lemon, lime, currant, etc. are very rich in acid while other fruits like pomegranate, ripe peaches, etc. are, on the other

hand very poor in acid content. As acid is one of the most important ingredient for jelly making, fruits poor in acid or low in acid do not produce good jelly. It does not mean that such fruits cannot be used for making jelly. They would indeed, make an excellent jelly if they are enriched with a suitable amount of artificial acid.

It is also very customary, however, to blend the juices of high acid content with the juices of low acid content, but the product thus produced does not possess a definite flavour of any of the fruits used.

So in order to retain the aroma of the fruit used for making jelly, artificial acids are most commonly used. These acids are citric acid and tartaric acid. The concentrated solution of these acids has given the best results. The strength used by the Horticultural Department of this Institute is 0·577 gms per c.c. of solution.

Preparation of Acid Solution.—Weigh out 577 gramms of citric acid crystals in a thoroughly cleaned 800 c. c. beaker and add to it about 200 c. c. of distilled water. Dissolve the crystal by warming the beaker gently over a slow flame. When all the crystals are dissolved, cool the solution and filter it through clean cotton in a 1,000 c. c. graduated cylinder, add a little water and stir it, then fill the cylinder to 1000 c. c. mark and stir it to a homegenous solution. So 577 gms. acid in 1,000 c. c. solution would give, ·577 gms. per c. c. of solution. In order to get the exact strength, titrate the solution, after diluting 1 c. c. to 500 c. c. with N. 10 solution hydroxide solution, using a drop of phenolphtalein as indicator.

A most simple and very practicable test for ordinary procedure could be performed as follows.

Squeeze out the juice from the ripe limes and take an ounce of it in a tumbler, dilute it to 8 ounces with water, add to it 1½ teaspoonsful of sugar. Stir it well. Compare its acidity by taste with the acidity of jelly stock intended for making jelly. If the jelly stock does not taste even as much acidity as in that diluted lime juice, the jelly stock is not fit for making jelly, unless it is enriched with artificial acid.

To be more accurate, the acidity of the juices can be tested by the following method.

Pipette out 10 c. c. of the juice to be tested in a 100 c. c. measuring flask, dilute the juice to the mark with distilled (free of acid) water. Take 50 c. c. aliquot part in a 400 c. c. beaker, add to it a drop or two of phenalphtalein indicator and titrate it with N/10 sodium hydroxide solution until a permanent colour is obtained. If the juices are highly coloured, dilute the above amount

to 500 c.c. in order to get a clear solution, so that it may not mask the end point.

Strongly acid juices should also be diluted to 10 times of the original volume. Calculate the percentage of acidity from the following factor:

One c.c. of N/10 sodium hydroxide neutralizes the following equivalent of acids:

Citric acid	0·0064 gms.
Tartaric	0·0075 „

Use of the Artificial Acid: The acid solution if prepared from the commercial crystalline acid must have 0.5 per cent strength. The suitable amount should then be determined by a series of experiments starting with four or five c.c. per pound of juice used increasing 1 c.c. every time until the appropriate amount is attained. This amount and the strength of the solution should then be recorded on the label of the bottle containing acid for future references.

Pectin: Pectin is another very important ingredient of jelly, without it jelly can not be made. Pectin is found in the middle lamella of the cell wall of fruits surrounded by the layers of cellulose. It is found in the pectose or protopectin, which on hydrolysis yield pectin.

Pectose (insoluble) is found in large quantities during hard green stage of fruits and as the fruit ripens it is converted into pectin (soluble) by enzymes and when the fruit is fully ripened it decomposes into pectic acid and methyl alcohol. So it is the pectin stage which is valuable from the point of view of making jelly. It is probable, however, that during boiling process the pectoes and protocellulose are hydrolysed to pectin.

The fruits vary a great deal in their pectin content. Some fruits are very high, others are very low in their pectin content, while in many fruits pectin is entirely lacking. There is no difficulty in making jelly from the fruits which are high in pectin content, but the real problem which faces one is the utilization of those fruits which do not contain or are low in pectin in jelly making.

The common practice in vogue is to blend the juices of those fruits which are rich in pectin with those which do not contain or are low in pectin. The product obtained by blending is not appreciated by the consumers, because it does not have any decisive flavour. In order to overcome this drawback, the only solution of this problem is to use a commercial pectin.

Preparation of Aqua Pectin: Select the fruits which are rich in pectin such as crab apples, currants, lemons, etc. Cut them

and soak them in cold water for 24 hours. Most of the acid and sugar will be extracted by the water leaving behind the pectin in the pulp. Draw off the water and cook the slices in fresh water containing about one per cent tartaric acid, until the slices become very soft. Press out the juice from the pulp, strain, and filter it. Concentrate the solution in vacuo to a thick syrup, sterilize it and seal it in bottles for use.

Preparation of Powder Pectin : Extract the juice from the fruits rich in pectin as described above and concentrate the juice to one-fourth of its original volume, cool it and add it slowly to twice of its volume of 95 per cent ethyl (grain) alcohol, with constant stirring. Let it stand for 15 to 20 minutes and then drain off the alcohol through cheese cloth and dry the precipitate on the screen at room temperature. Dissolve the precipitate in a small amount of distilled water, add it to twice its volume of ethyl alcohol and separate the precipitate by straining it through a muslin cloth. Dry the precipitate at 120° to 125 F. Grind the precipitate to a fine pulp and seal hermetically in tins for use.

Total failure in jelly or getting soft syrupy jelly is largely due to less pectin in the juices used for making jelly rather than to anything else. Many amateurs and even those who claim that they know jelly making fail many a time to get good results inspite of their accurate and thorough manipulation. The reason is not far to seek. It is because they have no knowledge and method of judging the pectin content of the juices. So it is very essential that a single method of testing pectin should be mentioned.

Method of testing pectin.—Take a spoonful of juice in a tumbler and add to it the same amount of 95 per cent (denatured) alcohol and stir the mixture slowly. If the juice is rich in pectin a thick gelatinous mass will be produced and if the juice is medium in pectin content a lumpy coagulation will form, but the juice poor in pectin will form a few stringy precipitate here and there. The alcohol will have no effect on juices which do not contain pectin.

The following table shows the pectin and acid content in different fruits which will be a very good guide.

Fruits rich in acid and pectin.	Fruits medium in acid and pectin	Fruits rich in pectin and low in acid.	Fruits rich in acid and low in pectin.	Fruits poor in both acid and pectin.
Sour apple ..	Ripe apple ..	Sweet cherries	Apricot ..	Pomegranates.
Crab apple ..	Blackberries ..	Unripe figs ..	Rhubarb	Ripe peaches.
Currant ..	Sweet orange ..	Carrots.		Ripe apricots.
Loganberry ..	Quinces ..	Unripe banana.		Ripe pears.
Sour varieties of blackberries ..	Cherries ..	Ripe quinces.		Raspberries
Lemon ..	Grapes.			Strawberries.
Lime ..	Loquats.			
Grape fruit.				
Pomelo.				
Oranges.				
Kumquat etc.				
Sour varieties of grapes.				
Sour plum.				
Sour varieties of cherries.				
Roselle.				

Sugar.—The consideration of the sugar content of fruits is of very little importance, because no jelly can be made without an additional amount of sugar. Therefore it does not matter whether fruits contain sugar or not, from the point of view of making jelly; but it is an additional sugar requirement which is an important consideration. Various sugars can be used for making jellies, such as sucrose, glucose, fructose and maltose, but sucrose, being cheaply manufactured and easily secured is generally used for such purposes.

It is not the presence of acid, pectin and sugar in the juice that would produce good jelly, but it is their relative proportion or combination which gives a really good jelly. Much work is done in other countries to find out the exact proportion of sugar to acid and pectin in order to get good results.

Relation of sugar to pectin.—No wonder many people fail to get excellent texture of their jellies in spite of their jelly stock being rich in both acid and pectin. It is because either they add too much or too little sugar in relation to the acid and pectin content of the jelly stock.

If the juices used for jelly making are difficient in pectin and too much sugar is employed the resultant jelly will be syrupy. On the other hand if too little sugar is added the texture of the jelly would be tough. It seems necessary therefore to lay down some definite rules for adding sugar to the various amounts of the pectin content of the juices.

1. If the juices are rich in pectin, from 1 or 1½ pounds of sugar may safely be used for every pound of juice used.

2. If the juice is medium in content, the amount of sugar added should not exceed more than ¾ of a pound for every pound of juice used.

3. If the juice is fairly rich, but not poor in pectin content ½ pound of sugar should be used for every pound of juice used.

4. As a general rule juices deficient in pectin require less sugar because the deficiency is made up by the evaporation of water.

The acid content of the jelly stock should range from 5 to 10 percent for satisfactory results. The amount of sugar used does not only vary with the pectin content but it also varies a good deal with the acid content. As a general rule the juices low in acid content require more sugar per pound of juice and give much less produce per pound of juice and pound of sugar used. This would be a great source of loss to the manufacturer. So in order to manufacture jellies economically either those fruits should be used which are rich in acid or the juices should be brought to the required precentage of acidity with the addition of commercial acid solution. Lal Singh through his experiments came to the conclusion that a juice having 0·12 per cent. acidity with 75 grammes of sugar gave 100 grammes of jelly, while juices having 1·05 per cent. acidity with 53½ grammes of sugar also give 100 grammes of finished product. From these experiments it is obvious that there is a great economy in raising the acidity to at least 1·05 per cent.

The causes of defects in jelly:—1. It is already mentioned that either too much or too little sugar will produce syrupy or tough jelly respectively.

2. Prolonged boiling or over-cooking produces gummy or sticky jelly which is probably due to the hydrolysis of pectin and sugar.

3. If too much water is used in the fruits when cooking them for the jelly stock it may also produce gummy or sticky jelly.

4. Crystals formation in the jelly may be due to the lack of stirring or adding too much sugar.

That a very considerable amount of Agricultural research is being carried on in India is evidenced by the fact that 105 papers were presented before the Agricultural section of the Indian Science Congress, held in Calcutta in January 1935. Besides these papers presented before the section on Agriculture, there were a number of papers presented before the sections on Chemistry, Botany, and Zoology which have a definitely agricultural bias.

KEEPING MILK GOATS IN INDIA

By J. L. Goheen, B. A.

Chapter V.

Care of the Young

In the chapter on Breeding, it was pointed out that the female goat should have special care during the period that she is "carrying" her young. That is the time when the care of the young should begin, for it is most important that the mother goat be given every opportunity to give birth to healthy, normal, fully-developed kids. It was pointed out that the choice of the parents has a very great deal to do with the kind of young that are to be born and this reminder will serve to keep fresh before one the need for selecting the parents and for giving the mother goat a proper chance to bring forth such kids as will be an improvement, even, over their parents.

Most female goats make good mothers, attending well to the cries of their kids. If only one kid is born it is a simple matter for her to feed it. If two or three are born it may be necessary, especially when they are very young, to see that the weakest or smallest of the lot has an opportunity to get sufficient milk, because the stronger ones may not give it a chance to do so. Generally the male kids are larger than the female, hence they will be able to push the smaller ones away.

The mother goat should be kept in her special compartment for about three or four days after giving birth to the kids, after which she may be allowed to go out with the others for grazing. The kids will want a drink of milk about every five or six hours, at least for the first week or two, and arrangements should be made so that the mother may have access to them at such intervals of time. When they are about two weeks old they will begin to be interested in nibbling at green feed or dry fodder, and it is well to make some arrangement whereby they may easily be able to get at small quantities of such feeds.

It is also advisable to make some arrangement whereby the kids may have an opportunity to be out in the open air and get some sunlight each day, especially about mid-morning or mid-afternoon when the sun is not too hot. For this purpose one of the large inverted baskets used by shepherds for small lambs is very suitable and not expensive. The green fodder can be tied in small bunches to the sides so that the kids will have to jump up to get at this feed. During the heat of the day a blanket or covering of some sort should be put over the top of this basket in order to provide shade for the kids.

Now, it is important that this basket be moved about from place to place at intervals of every two or three days, so that the droppings of the kids will not contaminate the soil too much. If that is not possible, great care should be taken each morning to sweep up all of the droppings most thoroughly and thus keep the place very clean. This point cannot be emphasized too much. Young kids and growing goats are subject to the infestation of several kinds of worms (generally called "internal parasites"), and once these enter into the stomachs and intestines of the animals it is very difficult to get rid of them. Therefore the matter of cleanliness in their quarters and in their feeding is of very great importance, for that will be the best means of preventing such infestation.

When the kids are about a month old they may be fed at longer intervals, say as much as 8 to 10 hours apart. And they may be also allowed to go out with their mother to graze. In order to keep them from taking milk from her in between their regular times, it is well to cover the udder of the goat with a bag which is to be tied up over her back with long strings. This bag should be kept clean, and should be tied securely so that it may not be lost or pushed off by rubbing against a tree or bush. The kids should be offered good fresh water to drink when the other goats are watered, and they should have opportunity to lick the salt lumps in the same manner as the other goats.

If it is not advisable for any reason for all the kids to go out grazing, they must then be provided with a special run, as was mentioned in Chapter Four. As every one knows, kids are very playful little creatures and it is highly important that they should be allowed to have plenty of exercise every day. Such attention to these little details will mean much for the proper growth and development of the kids.

When the kids are about 2½ to 3 months of age, the evening drink of milk may be dispensed with and when they are 4 months of age they should be weaned away from milk altogether, because by this time it will be possible for them to get along on solid feeds such as the older goats eat. However, if for any reason anyone should wish to allow the kids to keep on drinking their mothers' milk until they are 5 months of age, no harm will have been done, although it is by no means necessary that they keep on that long.

It is well to recall the fact also that all male kids, unless castrated early, should be separated from the female kids when they are about 2½ months old, if they are castrated there is no harm in allowing them to remain with the other kids. If not castrated it is a mistake to allow the males to remain in the same place with the females. Such males should have their special run, and their

special place in the stable, and very good care should be taken to see that their growth and development are in no way hindered or stunted.

It is a good thing to be friendly and playful with kids as they are growing, and to train them thus to have perfect confidence in their master. Such an attitude of confidence and of friendliness will mean much in their management because goats so trained will be obedient and easy to handle. Furthermore, because they trust their master they will be much more likely to have quiet dispositions, a point which is of much value both with the male and female goats. A little extra care in keeping goats happy and healthy will count for a very great deal from the time they are born until they die.

Summarising the few special points connucted with the Care of the Young, one should remember:

1. That there should be special quarters for the female goats about to give birth, also that the mother goat should have some special care and attention while she is "carrying" her young.

2. That most female goats make good mothers, but that if there are two or more kids born it may be necessary to take special care in seeing that the weakest or smallest have an opportunitiy to drink and are not pushed away.

3. That the mother should be kept confined in her special compartment for about four days, after giving birth, when she may be allowed to go out to graze with the other goats. She should be permitted to return to feed her kids at intervals of about every 6 hours during the first two weeks of their lives.

4. The kids should be kept out in the open air and sunshine for a few hours each day, an inverted basket being quite satisfactory for this purpose, or else they should have a special run of their own. Shade is neceasary in the heat of the day.

5. Absolute cleanliness is essential in all of the living and feeding arrangements of the growing kids. Arrangements, too, for play and exercise are also very necessary.

6. After the kids are about a month old the intervals between feedings from their mother may be increased to 8 or 10 hours, and at the time they are 3½ months of age the night feeding may be stopped, while all feeding from the mother should be stopped at about 4 months of age. When the kids are two weeks old they should be encouraged to start eating solid food, and from that time on the amount of such food should be gradually increased.

7. It is well to remember to separate the male kinds, such as are not to be castrated, from the females, when they are about 2½ months old. All castrated males may be allowed to run with the females.

8. Treating the kids in an affectionate friendly manner is important. Goats will become very obedient, and it is possible to train them to do many useful things.

Special Notes.

1. The compartment where the mother goat is kept should have in it a good bedding of dry straw or leaves at the time the goat is about to give birth. This is necessary both for the mother herself and the new-born kids. It is also most important to keep the udder of the mother goat free from all dampness and draughts of cold air when she is "fresh" and her udder is very tender. For this purpose bedding should be supplied to her for the first two or three weeks.


Pure Swiss Goat

2. If new-born kids are unable to suck the milk from their mother's teats for any reason, they may be taught to drink out of a shallow vessel, first by letting them such one's finger that has been dipped into such milk, then later by pushing their mouths gently down into the milk itself. Only small quantities of milk should be fed this way, never more than a pint at a time. Because it is so easy to get this milk, without any sucking or effort, the kid will want more than it should have. Hence only a small amount should be given at a time, and absolute cleanliness everywhere is essential, if this method of feeding needs to be done.

Vinca rosea or PERIWINKLE, known in Hindustani as GULFIRING is a very common evergreen flowering plant in the plains of India. It is a small plant and is generally grown in gardens because of its resistance to drought. Its flowers are either pink or white. It, however, sometimes grows as a weed on the farm.

Mr. C. T. White, a Government botanist of Queensland claims that the leaves of this plant are as good as insulin in the treatment of diabetes.

The leaves about twenty-seven of them, are taken and boiled fifteen minutes in three and a half cups of water, and then strained. Each cup of this should be taken after each meal and this to be followed after an hour by half a glass of warm water in which a little bicarbonate of soda has been dissolved.

METEOROLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE FARM

December, 1934

Date.	Maximum Temperature.	Minimum Temp.	Mean Temp.	Percentage of Humidity.	Atmospheric Pressure	Rain for the day.	Rain since Jan. 1	Wind direction.	Remarks.
1	73	48	60·5	60	29·80	Nil	28·37	W.	Levelling continued.
2	70	46	58·0	70	29·86	,,	,,	S.S.E.	Ploughing in *Arhar* crop after harvesting *Bajra* and other crops follow.
3	69	46	57·5	85	29·84	,,	,,	E.	
4	69	50	59·5	90	29·88	,,	,,	E.	
5	70	50	60·0	76	29·86	,,	,,	E.	Preparing fields for sowing hill potato.
6	76	60	68·0	70	29·88	,,	,,	N.E.	
7	74	53	63·5	76	29·88	,,	,,	N.	Sowing hill potato started.
8	76	52	64·0	82	29·88	,,	,,	E.N.E.	
9	70	49	59·5	80	29·82	,,	,,	E.	Harvesting Napier grass.
10	76	51	63·0	78	29·86	,,	,,	E.	
11	76	54	65·0	89	29·90	,,	,,	E.	
12	76	51	63·5	95	29·88	,,	,,	E.	Weeding of wheat started.
13	74	49	61·5	92	29·87	,,	,,	E.	Harvesting of *Bajra* and *Grain-juar* continued.
14	69	49	59·0	90	29·90	,,	,,	E.	
15	74	49	61·5	92	29·85	,,	,,	E.	
16	70	48	59·0		29·80	,,	,,	E.	Sowing of hill potato continued.
17	79	50	61·5	75	29·76	,,	,,	E.	
18	78	50	64·0	84	29·80	,,	,,	E.	
19	82	55	68·5	76	29·76	,,	,,	E.	Plucking and sale of vegetables continued.
20	80	53	66·2	80	29·76	,,	,,	E.	
21	80	58	69·0	90	29·80	,,	,,	S.E.	
22	76	54	65·0	88·0	29·78	,,	,,	W.	
23	76	54	65·0	80·0	29·78	,,	,,	W.	
24	77	51	64·0	70	29·78	,,	,,	W.	
25	78	52	65·0	84	29·76	,,	,,	N.W.	Digging of early potatoes started.
26	73	55	64·0	84	29·75	,,	,,	N.W.	
27	75	51	63·0	84	29·66	,,	,,	E.	Threshing and winnowing of *Bajra* & *Juar* continued.
28	71	55	63·0	82	29·69	,,	,,	E.	
29	74	56	65·0	88	29·78	,,	,,	W.	
30	72	52	62·0	74	29·76	,,	,,	W.	
31	69	43	56·0	64	29·74	,,	,,	W.	

January, 1935

Date	Max. Temp	Min. Temp	Mean Temp	Percentage of Humidity.	Atmospheric Pressure	Rain for the day.	Rain since Jan. 1	Wind direction.	Remarks.
1	70	39	54·5	78	29·72	Nil.	Nil.	S.W.	Levelling & ploughing of fallows continued.
2	72	43	57·5	74	29·70	0·22	0·22	E S.E.	
3	65	53	59·0	92	29·74	0·06	·28	N.W.	Digging of early potatoes continued.
4	66	40	53·0	90	29 80	,,	,,	Calm	
5	67	41	54·0	90	29·81	,,	,,	S.E.	Cultivating hill potatoes.
6	67	40	53·5	84	29·82	,,	,,	S.W.	
7	68	42	55	80	29·84	,,	,,	W.	
8	68	40	54·0	68	29·90	,,	,,	W.	
9	71	41	56·0	75	29·90	,,	,,	W.	
10	71	44	57·5	80	29·88	,,	,,	S.W.	Plucking, harvesting and sale of vegetables and potatoes continued.
11	72	44	58·0	88	29·80	,,	,,	Calm.	
12	75	46	60·5	75	29·68	,,	,,	E.	
13	76	48	62·0	76	29·66	,,	,,	E.	
14	79	56	67·5	80	29·65	,,	,,	E.	
15	79	50	64·5	55	29·67	,,	,,	W.N.W.	
16	72	40	56	58	29·75	,,	,,	W.	
17	69	43	56	36	29·79	,,	,,	N.	
18	61	37	49·0	50	29·89	,,	,,	W.	Cutting Napier grass for feeding cattle.
19	68	38	53·0	55	29·93	,,	,,	W.	
20	70	36	53·0	71	29·88	,,	,,	W.	
21	71	38	54·5	73	29·90	,,	,,	W.	
22	74	40	57·0	75	29·80	,,	,,	Calm.	Weeding of Wheat. Sowing Banda (Yam) after harvesting early potato.
23	75	42	58·5	76	29·79	,,	,,	S.W.	
24	76	45	60·5	57	29·84	,,	,,	E.	
25	76	52	64·0	60	29·82	,,	,,	E.S.E.	Roguing wheat crop started.
26	74	53	63·5	80	29·84	0·20	0·48	N.N.E.	
27	72	54	63·0	90	29·82	Nil.	Nil.	S.W.	Threshing and winnowing of *Bajra Jowar, Mung* and *Juar.*
28	70	58	64.0	87	29·80	·19	0·67	E.	
29	73	61	67·0	80	29·78	Nil.	,,	E.	
30	73	60	66.5	95	29·78	·09	0·76	N.	
31	73	60	66.5	92	29·76	Nil.	,,		

THE HIGGINBOTTOM ASSOCIATION

In connection with the Annual Farmers' Fair which was held on the 27th February to March 2nd, a meeting of the Old Boys of the Allahabad Agricultural Institute was held, to which the old boys were invited as guests of the Students' Union of the Institute.

In the meeting several letters were read by Mr. Jhosi, the Secretary of the Higginbottom Association, in which some of the old boys from as far as Bombay Presidency expressed regrets of their inability to come but wished the Higginbottom Association to grow, as they believed that this is the tie that will bind all the old boys together to their 'Alma Mater', the Allahabad Agricultural Institute.

For those who wish to have more information about the Higginbottom Association we would say that they should correspond with Mr. N. R. Joshi, of the Animal Husbandry Department, who is the Secretary of the Association, or with Mr. B. M. Pugh, Editor of THE ALLAHABAD FARMER of the Agricultural Institute. All cheques and money orders for the Association should be sent to Mr. Mason Vaugh, Agricultural Engineer also of the Argicultural Institute, who is the treasurer of the Association.

We would like to remind those who wish to become members of the Association that the ordinary membership fee is Rs. 5 annually. The subscription of THE ALLAHABAD FARMER for the members of the Association is also Re. 1-8 only.

A Rural Home Section will be included in THE ALLAHABAD FARMER from its next issue. Mrs. Higginbottom will be responsible for the section. It is hoped that we shall have in that section several articles which will deal with problems in the rural home, such as 'health in the rural home', 'a kitchen garden', 'children in rural homes', 'cooking in rural homes' and several other problems. We believe that there is a great need for articles of this type and the public in these days will eagerly look forward to them when everybody seems to talk about rural reconstruction, and problems connected with it. We also congratulate ourselves for having secured Mrs. Higginbottom, who is so keenly interested in these roblems, to conduct this section of the FARMER.

Mrs. Higginbottom would be glad to receive contributions m all those who are studying and grappling with the problems he rural home in India.

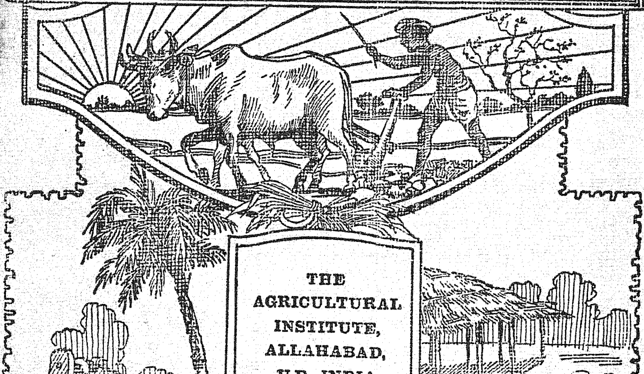
VOL. IX] [No. 3

THE ALLAHABAD FARMER

A bimonthly Journal

OF

Agriculture and Rural Life



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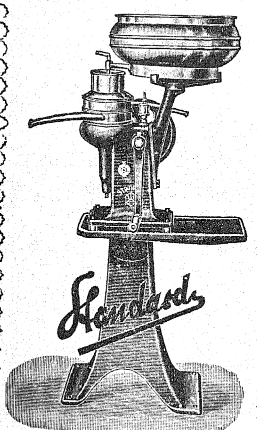

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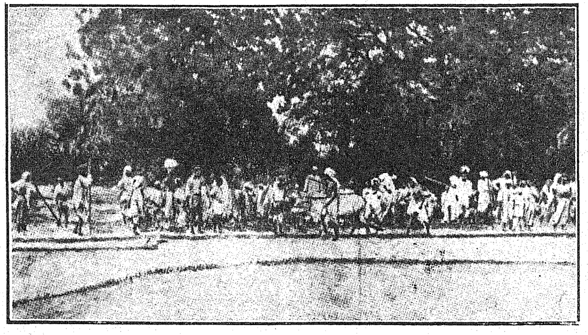

PLOUGHING DEMONSTRATION

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The Wah-Wah plough continues to win favour and users —"better than medals and prizes; it is being bought in increasing numbers for actual use."

See Vol. VII, No. 3, May, 1933, of *The Allahabad Farmer* for a description of the "Wah-Wah" plough.

See the advertising section of the current number for particulars regarding cost.

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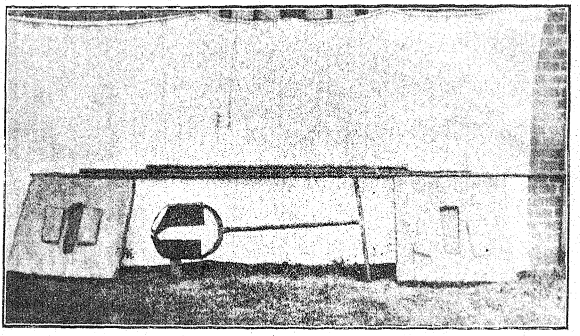

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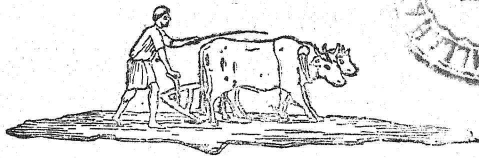
The Allahabad Farmer

A BIMONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE



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A BIMONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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One single half page	6	0	0
Page 2 or 3 of cover for six numbers ...	75	0	0
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Contributors will receive 15 reprints of the article published and additional copies at cost.

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THE
ALLAHABAD FARMER

VOL. IX] MAY, 1935 [No. 3

Editorial

Board of Agriculture

The first meeting of the reorganized Board of Agriculture, Crops and Soils wing, met in Delhi from the 25th of February to 2nd March 1935. This was the first meeting of the Board under the new scheme. There were over 70 members, officials and non-officials present. The Board was broken up into 9 different sections, to each was committeed one important subject. The first two days were spent in committees studying the various papers put before the different sections, also various questions submitted directly to the Board. These sections covered practically the whole field of agricultural endeavours in India exept animal husbandry. The findings of each section were brought in to the full meetings of the Board. They were discussed and conclusions were arrived at which will be published in the official records of the Board.

The meeting was very ably presided over by Sir Dewan Bahadur T. Vijayarachavacharya, K. B. E., who had remarkable powers of summing up situations and guiding the Board in sticking to the main issues involved. It was an exceedingly enriching experience to hear the experts from all parts of India discuss the various agricultural problems that are of such vital importance to India. I do not wish to comment at any great length on the ordinary work of the Board; but this Board meeting differed from most of the other Board meetings that I have attended in that a new note was sounded.

We sometimes forget how modern scientific agriculture is, in any part of the world. During the early days of the department in India it was compelled to do a lot of fundamental research which in the very nature of things could not bear fruit for a good many years. The Government of India has been fortunate in getting some truly great men into its service like Lefroy in Etomology, Sir Albert and Mrs. Howard in Economic Botany, whose Pusa wheats are still leaders in India and spreading in other countries having enriched India by crores of rupees. Dr. Barber who did such great work in breeding and proving new varieties of sugar-cane, Dr. Clouston with his improved cottons for the C. P. and J. B.

Knight of Poona who did so much to forward the teaching of scientific agriculture. The list could be very greatly extended. It is difficult to measure the debt that India owes to this devoted body of highly qualified scientists.

The problems of fundamental research were so pressing that these men had little time to give to other important sides of the work. But those who have entered into the rich inheritance left us by these great pioneers now recognise that their discoveries must be carried from the research laboratory and experimental plot to the ordinary village farmer, if research is to be really successful. So the largest committee of the Board discussed for two days various methods of propaganda. An enumeration of the successful methods that have been tried in India will be printed as part of the findings. An officer of the Imperial Council is to secure information from all over the world and put before the various agricultural authorities in India. This I take it was one of the outstanding achievements of the meetings of this Board.

I left the Board of Agriculture greatly encouraged. If these officials represent the mind of Government, then Government is determined to make the fullest use possible of the latest scientific discoveries in agriculture with a view to reducing the cost of production and increasing the amount produced. This, of course, will greatly benefit the Indian farmer. This village farmer seemed to be more and more the objective for which all were working. When he raises bigger crops for less money per unit, India will surely be better off than she is today. The non-officials nominated by the different provincial governments and the keen interest they took in the discussions, shows that non-official India is waking up to the improvement of agriculture. When the people of India co-operate to their fullest extent with the Government of India and the Provincial Governments in promoting a better agriculture, we can look forward with hope that a better day is dawning for India.—SAM HIGGINBOTTOM.

* * * *

Jobs for Former Students

We have just learnt that the Director of Agriculture, United Provinces, is looking for men who have passed the Intermediate in Agriculture, to employ them at Rs. 30 to Rs. 35 per month, on some sort of Reconstruction Programme in the villages. We would urge the unemployed graduates of the Agricultural Institute to correspond with the Director regarding this.

(*Continued on page 109.*)

AN EXPERIMENT IN RURAL EDUCATION: A REVIEW.

BY MRS. SAM HIGGINBOTTOM

Because of the large number of Mexican children in the southern part of the United States and the difficulty in getting them interested in school work, Mrs. Katherine Cooke was sent to Mexico to study their new system of Education. The "House of the People" was her report, issued in the hope that it would stimulate more study of Education systems among primitive people. She found that John Dewey, one of the United States' foremost educationalists was the basis of study for Mexican teachers. To show how much all Mexico is interested in this rural education, Mrs. Cooke's guides and companions on her school visiting expeditions were largely Mexican Federal school officials who tried to interpret school policies and practices to her.

There is much in this investigation which shows Mexico's comparability to India. Although Mexico has only 14 million inhabitants, the large proportion of them are rural. They live mostly in small villages which vary in population from 100 to 500. They have many petty industries and handicrafts carried on in the villages, among which are the making of seraps, (a bright coloured hand woven garment), baskets, pottery, tiles, tools, hand wrought silver, hats and glass. In general, agriculture supplements the handicrafts; tools are simple, even primitive; wooden ploughs resembling ancient Egyptian ploughs are common and their use is an example of the historic methods employed in the varied industries carried on. Singer Sewing machines are an exception as they are found in most of the villages and seem to be the one kind of modern machinery which has gained favour. Many of the villages are self-sustaining; growing and making all they need. Indeed the lack of any consciousness of need has been the despair of those who would like to trade with Mexico's rural population. One historian calls it "wantlessness" due to which manufactured articles have found little sale.

Their *houses* are chiefly the 'adobe' huts, or mud huts, as we say in India, with bamboo and thatched roofs, sometimes with tiled roofs. One room answers all purposes for the family. The more spacious homes are of the same material, the rooms being built around a *patio* or courtyard. Therefore Mexican villages are much alike in appearance and the manner of living is practically the same in them all. There are 50 different dialects in use. Spanish is however a common language and most of the children desire to learn to use it. As you can see from the above, the economic level throughout rural Mexico is low.

This briefly is the *situation* which the new rural schools are established to improve.

In the beginning the Educational Department sent out so-called "missionaries" chosen from among enthusiastic village people. They went from village to village throughout the country to preach the gospel of a new school invigorating the people and urging them on to a new day. When a community became aroused to the *need of a school* it was established with a teacher selected from its own locality with the assurance that the community would share the responsibility of building and maintaining the schools. The teacher's salary was paid by the Federal Government, no equipment was sent and no curriculum was suggested. The teacher aroused at once a strong social sense and since he had no normal training he began school without a tradition.

In a real sense *the teacher* is the school in Mexico. While selected by Federal Educational officials he must be agreeable to a local school committee and preferably selected from the community. The first requirement of the teacher was that he should have a quality of leadership, and, second, common sense. The teachers are all men and women of good will, physically and morally strong with a fundamental belief in their education; most of them have finished their primary school work but many do not fulfil any other requisite commonly demanded of a teacher. But they do have an apostolic devotion to their work.

The curriculum is neither imposed nor prescribed by a central authority. School work day by day is chosen to contribute to the social and economic welfare of the community through activities growing out of these specific and immediate needs. The "teacher leader" is responsible largely for the selection and conduct of school products and community activities. Problems are tackled in order of their importance to the community. If for instance they are in need of sanitation, a pure water supply for example, then the people would be taught the reason for pure water. The mysteries of filtration and how to make a filter. The teacher is there to help them to make and use the necessary equipment. He gets his material and help from the Education Department. If small-pox is the recurring plague in the region, the need of vaccination must be taught and the teacher or community leaders will be instructed how to vaccinate. The use of simple medicines is taught.

Frequently there is need of improving agriculture or the quality of the products of the local industries, means of marketing products, for instance, pottery, weaving, basketry. In such cases the need becomes the basis of the school curriculum. If housing conditions must be improved, carpentry then becomes part of the school curriculum. Generally the diet must be improved. In order to give a variety of food the school garden is a part of every

school and projects are selected and carried out, designed not only in the growing of vegetables but in their cooking, preparation and preserving. The needs are many and several practical activities are usually going on at the same time in each school. The reputation of the success of one community school spreads, stimulating other schools and other communities to develop like projects. Every school has a workshop even though it may be only a corner of the room and more than half of the schools now have open air theatres as part of their equipment. The school buildings themselves are built by the community for their equipment largely depends on the desire of the community for ordinary or an improved variety. Some schools have only benches and crude tables, others have improved chairs and desks. There is nothing elaborate or expensive in the equipment such as intricate maps and other teaching paraphernalia. Every school has a play ground devoted to community recreation, and generally the school building and surroudings is the most attractive place in the village although the buildings are of the simplest design. It is the most sanitary place in town. "There may be no municipal building, no band stand, no iron balconies, no shop, but increasingly there will be a school," Mrs. Cooke says. Again and again, as the little square white buildings with its red-tiled roof shone out from the prevalent village grey or brown, I was reminded of my country. The outstanding piece of architecture in an American town is almost invariably the high school. Mexico, at a totally different economic level is following the same trail ! ! Generally the schools are new. One story, rectangular, flat-roofed *adobe* structures, stuccoed and painted or white washed an immaculate white, with shining red-tiled roofs. On the door the Spanish words-meaning "The House of the People"—a Community House. A representative rural school would have about 40 children of all ages and both sexes. It still has only a 4 year course which will later be extended to 6 years. It has a department of personal cleanliness, a health department with its medicine chest, a library, a chicken house, rabbit hutch, flower garden, vegetable garden, play ground, outdoor theatre, soap making, pottery work, weaving, embroidery, carpentry and other industrial departments. All of this has been accomplished by the children aided by various community organizations. Often times there is also a string orchestra with community concerts and singsongs.

All of this is brought about through untrained teachers who are gradually trained by *travelling inspectors* who stimulate them to seek out the community needs and find out how to satisfy those needs. Once a year teachers from a locality are gathered into a normal school which travels about spending a month in each centre. This is called a cultural mission and is composed of a group of

specialists—one an agriculturist, one an expert in industries, one in popular arts (music, drawing, drama) one in physical education including recreation sports, games, a nurse and a community social worker. This last named is a "key" person since the rural school is the centre of the social and economic life of the community. Teaching of domestic science, the care and feeding of infants and general home making activities are incharge of the community specialist. The teacher thus is trained while in service in preference to pre-service training. For had they waited for the later, Mexico's educational programme would have been delayed in its start and thus lost much of its enthusiasm. One does not hear much about efforts to eliminate illiteracy, a matter so absorbing in most educational systems. While there is instruction in the fundamentals, sometimes called the three R's (reading, 'riting and 'ritmetic) it is more or less incidental to the main purpose. Books while not abundant are attractive, generally delightfully illustrated but kept inexpensive.

School projects initiated by teachers sometimes grow into larger *social polices* which become nation-wide in scope. The campaign in many rural communities to overcome the excessive use of alcohol was initiated by a teacher in his community where there was a real need for reform. Because of his success other teachers were encouraged to promote the movement, and the campaign at present is country-wide, sponsored by the Federal Health Department as well as by the schools.

All schools also have a *model cottage* built on the school ground. Here is a direct message to the Mexican child and adult. The model is simple. Building is an essential in every boy's education. In it are improved facilities in arrangement, lighting, sanitation, and equipment. Typically it is a 3-room *adobe*, whitewashed, tile-roofed house. There is a living room, a bedroom, and a kitchen, with a built-in combination stove and sink, also of native material, generally unglazed tiles. Houses of this kind will eventually, it is hoped, replace the prevailing 1-room type which answers all household purposes for the Mexican family.

Adult education is of *primary*, not secondary, importance in Mexico. From the beginning it was recogized that if the school concerned itself with children only, it would not accomplish the desired outcome, that whatever the school might do for the children an inert community would quickly undermine. It was also recognized that however large the store of knowledge, habits, and skills acquired during the school period, the adolescent who returned to an unchanged community would quickly take on its life rather than the new one of which he had learned at school.

Night school is a meeting place for people of the village, a

place where they can talk to each other, can sing together and hear a little of the outside world, especially of the school changes under the way in Mexican villages. They also discuss common interests and local problems, health programmes initiated or plans for social programmes. Often times the night school has more enrolled than the day school. The teachers are supposed to carry out programmes of amusement and recreation for the community. One rural teacher describes his night school thus :—

> "Many come both men and women. Sometimes there are as many as 50 in a group. They do not attend with the regularity which one would like to have, as their occupations do not always permit this, but always when they do come it is gladly and with real delight. We teach them what we can, but mainly what they especially want to study. Some study reading, some writing, some ask for instruction in small industries and others in agriculture. Women ask for lessons in home economics, especially with reference to cooking and sewing. We have formed different groups according to their interests and needs. While adults study these practical things they are also learning to sing and to play some instruments, as they have a native love of music and beauty. I am delighted with the social progress which we are making. The streets are swept now; the outsides of the houses have been whitewashed; the people dress with more cleanliness, are cleaner; excessive drinking is disappearing somewhat; the fly plague is abated; the people vaccinate against smallpox; the whole village comes to the festivals and concern themselves with the progress of the children in school".

To summarize, Mexico, educationally, is on the march. Can we in India make use of any of her schemes? By drawing on each village to produce its teacher? By having land attached to each school house for farming, industries, model cottage, recreation? By organizing adult population into classes for improvement stimulated by the village teacher and travelling teachers giving a few weeks in each village, duration to be according to the need and desire of the village? And last, but perhaps most important, travelling training schools choosing each year a different village for its centre that not only each teacher, but each village, may have the stimulation?

(Continued from page 104.)

Since people have been constantly writing to the Principal of the Allahabad Agricultural Institute regarding men who would be available for some employment in the province as well as in certain Indian States, we would advise all our former students of the Institute to correspond with the principal and let him know what they are doing now. We do not of course, guarantee that we shall always be able to provide them with jobs, but we are confident that a few of them will be well placed.

SUNNHEMP AND CREEPERS

By Thakur Dudh Nath Singh, Lecturer in Botany,
Agricultural College, Cawnpore.

With the growing use of sunnhemp (Sanai) as a very promising green manuring and fibre crop the damage due to wild weeds in the farm of twining creepers deserves serious notice. For, inspite of good cultivation and care the creepers appreciably lower the outturn and deteriorate the quality. Cawnpore 12 Sunnhemp is easily the best variety of the province. From experience of a number of years with this crop at the Botanical Research Farm, it is concluded that the general complaint against Indian Sunnhemp Fibre in the world market is largely due to the unrestricted mixture of this crop with weeds.

The complaints against the fibre are that it is (*a*) short (*b*) tangled and (*c*) dirty. These defects are mostly due to the presence of wild creepers since the weeds not only deprive the sunnhemp crop by sharing the natural reserve of food material in the soil but they also form a regular thatch like roof on it (Plate 11 photo 1) thereby cutting off sun light from the cultivated crop. This is mainly resposible for the stunted growth of even tall growing variety like C. 12.

Again, if sunnhemp has been properly retted, the fibres can be pulled off the woody central part and they are never tangled. But a regular wrapping of a creeper, if present, must either be removed before extracting the fibre or the fibres become a tangled mass, full of bits of creepers as is commonly met with in the local market and the pieces or bits of creepers which remain sticking with the fibre, further deteriorate its quality and depreciate its value. It is, therefore, evident that so far as the quality of fibre is concerned, the chief problem for the cultivator is to eradicate the creepers because to advocate the untwining of creepers at the time or retting or extraction would not be feasible.

Further, a green manuring crop should have three principal qualities :—

(1) It should be capable of adding Nitrogen which Indian soils usually lack.

(2) It should rot quickly when buried.

(3) It should be easy to plough in.

The creepers are not leguminous like su[illegible]p, Arhar, Pea etc. which enrich the soil by adding nitrogen fr[illegible]e atmosphere. They do not rot quickly like sunnhemp and m[illegible]e it difficult to plough down even sunnhemp. Thus they are an equal nuisance whether the crop is grown for fibre or green-ma[illegible]ring.

If, however, seed is to be taken, the presence of creepers is a still greater danger in as much as its effect does not end with the present crop but continues to multiply with increased vigour in the succeeding crops, as the seeds of the creepers ripen either earlier than or with sunnhemp. In the former case the seeds of the creepers are shed in the fields before Sanai reaches maturity while in the latter case they are harvested along with the crop and thus the sanai seed after threshing is a hopeless mixture. All the foreign seeds are almost of the same size as sunnhemp and cannot, therefore, be separated by any mechanical method like sieving.

However, if the cultivator follows the suggestions given below for his information, he can very easily save his crop from these weeds.

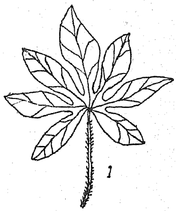
1. In a standing field, those patches should be located where not a single creeper is found growing and clean seeds threshed out from these alone, should be reserved for next year's sowing.

2. These twining weeds must be removed from the field before the crop grows high enough to make weeding impossible. Experience tells us that weeding must be completed within a month after sowing. Otherwise the crop grows too thick to allow any such operation.

The following description of the weeds with two plates (No. 1 showing the characteristic types of their leaves and No. 11 their photos is designed for the help of those who do not recognise them.

Detailed description of the creepers mentioned above.

(1) Ipomœa pestigridis (Vernacular names—Ghiya, Khutla or Bhadera).



1

Stem.—With big hairs all over.

Leaves.—Hairy on both the dorsal and ventral surfaces and palmataly lobed (5-9 lobes).

Petiole.—1″—3″ long.

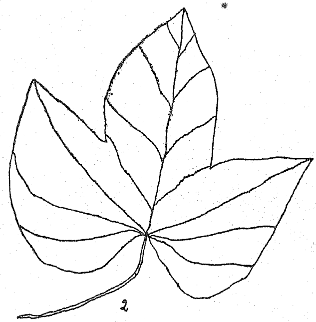
Flowers.—3—4 flowers are found in a cluster.

Petals are either white or rose coloured.

Corolla.—Infundibuli form or funnel shaped. The plant is a

twining herb and comes into flower either by the end of September or in the beginning of October.

(2) Ipomœa hederacea (Vernacular--Nilkalmi).



2

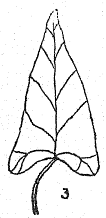
Stem.—Sparsely hairy.

Leaves.—Broad and having 3 lobes.

Flowers.—Upto 5 flowers can be found in one and the same cluster.

Corolla.—Bluish with lower portion either rose or orange coloured, long and tubular infundibuliform.

Fruit contains about 6 seeds. The seeds known as Kaladana are used as purgative.



3

(3) Ipomœa eriocarpa or 1. hispida (Vernacular—Bondi).

Plant.—Sparsely hairy.

Leaves :—

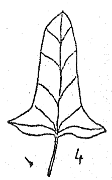
(*a*) Petiole—about one inch in length and hairy.

(*b*) *Lamina*—2″—3″ long, simple, hairy and lobed.

(*c*) Base of the lamina cordate.

Flowers.—Sepals and petals are nearly equal in length Calyx—Hairy.

Corolla.—Rose coloured and Campanulate or bell shaped.



4

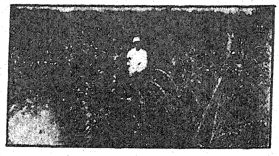
Fruit.—Capsule and hairy.

Seed.—Small pits are discernible on the surface of the seed when examined under the microscope.

(4) Convolvulus arvensis (Hirankhuri).

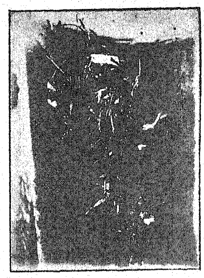
Stem.—Aerial and subterranean both. Twining, slightly angular.

Leaves.—Simple, alternate, petiolate. Exstipulate and hastate.



Creepers forming a thatch like roof

Ipomea Pestigridis



Ipomea Eriocarpa or I, Hispida

Cocculus Villosus D. C. or Menispermum
Hirsutum Roseb

Flower.—Solitary, regular and bracteate.

(*i*) *Calyx*—Polysepalour and imbricate.

(*ii*) *Corolla* (5) Small, infundibuliform.

Limb.—Plaited or plicate in bud stage.

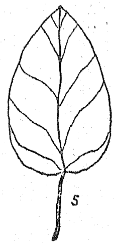
(*iii*) *Stamens 5*—Epipetalous.

(*iv*) *Carpels* (2) Superior and Syncarpous.

Fruit—a capsule having 4 seeds.

This plant is commonly known as small Bindweed and is found all over the province. It does not grow so bushy as the three Ipomœas mentioned above. But because of its binding habit and countless number, the creeper does a considerable damage to the sunnhemp crop.

(5) Cocculus Villosus D. C. or Menispermum hirsutum Roxle (Vernacular—Charahanta or Karsana).



5

Branches, leaves and flowers are all covered with grey hairs.

Leaves.—Simple, petiolate and 2″—3″ in length; sometimes lobed also.

Flowers.—Universal.

Plant is sturdy. It can flourish well even in bad soil and at times of draught. In spite of all this, the plant is less harmful than the 4 creepers described above because it flowers in February and March after the Sanai crop is harvested.

* * * *

In the end I wish to express my deep sense of gratitude to Mr. T. S. Sabnis, I. A. S. for the photographs herein attached.

It is understood the Potato Marketing Board of England will soon take steps to establish a factory in an intensive growing area in the Eastern Counties, and that the building will be completed in advance of the 1935-6 main crop season.

For some months the Board's Industrial Development Committee and the Executive Committee have been in negotiation with the Farmers' Marketing and Supply Committee with a view to the Board's co-operation in connection with the building and running of a factory for the manufacture of feeding stuffs, of which dried potatoes will be an imptortant constituent. Under an agreement which has been signed, the Board is to assume certain responsibilities in connection with the provision of potatoes for the factory, and the Board will also play a part in connection with the price which producers will receive,

A REVIEW OF THE PLANT HYBRIDISING WORK DONE IN INDIA.

(By S. Sarup, M.Sc., Lecturer, Jaswant College, Jodhpur.)

Very little work has been done on plant genetics in India and for theoretical conceptions underlying the practical aspects of the subject we have to depend on the work of Europe and America. Only recently the Agricultural Research council has made a substantial grant to finance a research scheme in Plant Cytology. However in the improvement of the plants India stands second to none. There is no country in which greater economic results in plant breeding have been obtained, nor perhaps which has better equipped experiment stations for such investigations.

Wheat occupies about 24,000,000 acres in India. High yielding, rust resistant, cross bred varieties with good milling and baking qualities have been produced through the indefatigable labours of Dr. and Mrs. Howard and others. Wheat of very fine quality has been produced and is being grown over a large area. Pusa "107" produced at the Agricultural Research Institution won a prize at the Royal Agriculture Show at Sydney and was followed with a difference of half of a mark by Pusa "4." This was selected by Dr. A. L. Humphries a former president of the National Association of British and Irish Millers. He considered it to be as good as any wheat produced in the World and selected it as his first choice of all Indian wheats for bread making purposes. No less than 50 series of improved Indian Wheats have been produced. "Pusa 52" a cross between Punjab 9 and Pusa "6" combines the high yield and bearded nature of the former with rust resistance of the later.

"An important new production is Pusa 111. This wheat has been grown at Pusa and in Sind under dry and irrigation conditions respectively and has been successively subjected to milling and baking tests in England in comparison with other Indian wheats and with Canadian wheats."[7]

The Punjab Agricultural Department has already completed a series of tests on a new improved variety of wheat grown in the province known as "Cross 518." The variety is stated to be the best of all other kinds grown so far in the province, under the same conditions of soil fertility and water supply. It is stated that in the last season a cultivator realised a record yield of 49½ maunds of grain per acre from this sort.

The improved types produced at Pusa have already benefited the country considerably. 25,00,000 acres have already been planted with the improved types.

Important as the results are these results have not been so much availed of by the uneducated and conservative Indian

peasant. If the spread of new varieties of Pusa wheat is compared with that of Marquis in Canada and the Northern States of the Union, we realise the fact. In fifteen years Pusa wheats have covered a little over 2,000,00 acres. In about the same period the area under Marquis has exceeded 20,000,000 acres.[4]

Rice is the most important crop and covers about one-third of the total cultivated area. Beale[2] did the most useful work in the classification of Rice found in Burma and Mitra[8] in collaboration with Gupta and Gongoly worked on colour inheritance in Rice.

So far attempts to produce good hybrids of Rice have not met with so outstanding a success as in wheat. The matter is receiving the attention of a number of workers.[3, 10] Breeding work is at progress at Kajrat, Dacca and Coimbatore. Bengal Agricultural Department has produced a true breeding variety which flowers and fruits two to three weeks earlier than the pure line types. Thadani[14] working at Sakrand made crosses between selected strains and other varieties possessing high tillering and large number of grains in the ear head to obtain further increase in yielding capacity.

Oats:—Two Pusa selections crossed with Abundance and Scotch Potato varieties of oats have produced very encouraging Hybrids as regards higher yield and better quality as compared with Local varieties. The good grain and stand quality together with the heavy tillering power of imported varieties (European types) have been combined with the earliness and disease resistance of the Indian parent.[12]

Millets:—The Royal Commissioners in their Report[11] deplored the fact that the Agricultural Department of India was still at the beginning of the work on improving Juar (Sorghum Vulgare) and other millets.

Sugar Cane:—At the Imperial Sugar Cane Research Station Coimbatore, valuable results through hybridsation have been achieved. Several new varieties have been produced by crossing with Saccharum Spontaneum L: as one of the parents. It may not be out of place to mention here that it was Dr. Barber who first deliberately used Saccharum Spontaueum for crossing with Sugarcane. Thousands of plants[16] have been raised of which a few notably Co, 205, Co, 213, Co, 290 have been widely distributed in United Provinces and in North Bihar. Coimbatore canes are being successfully reared outside India as well, especially in Cuba and Florida. A recent communication from Florida to R. S. T. S. Venkataraman states that in spite of rather difficult conditions of soil and climate "it looks as if Co. 281 cane would be one of our best if not our very best cane."

Almost all important characters have been studied and large number of crossings made to improve the various characters. A cross between Vellai Indian cane and Saccharum—spontaneum resulted in doubling the average weight of seedlings at harvest. Tillering has been improved by suitable crosses and double the number of seedling producing varieties have been produced.

Characters of root (depth, penetration through stiff soils and resistance to water logging and the thickness, length and shape of the internode have been improved to a very great extent.

Hybrids with Saccharum Spontaneum L. have been noticed to be generally immune to smut, which is otherwise a common disease in Indian canes. Quality of price (resulting in the greater percentage of sucrose in juice) has been improved. Other characters as habit of plant, inheritance of ivory markings on joints have been crossed to advantage.

Astounding results have been obtained by R. S. Venkataraman[17] in producing early maturing varieties by crossing sugarcane with juar (Andropogon Sorghum) as one of the parents. Seven hybrids co. 351, Co. 354, Co. 355, Co. 356, Co. 357 have been produced. More crosses are being made. These hybrids tend to come to maturity in six to seven months from the time of planting and maintain a high quality of juice.

Cotton :—The bulk of the cotton comes from black soil areas of the Peninsula where the growth period is short as the cotton is raised on the natural rainfall. The conditions exclude a long staple and favour rapidly maturing varieties. Here the problem was to increase the yield per acre. Patel[9] (1919—20) crossed Broach Deshi (1027 AL.F. and I.A. Cylindrical bol 1) and E 5 cottons, all strains of Gossypium herbaceum. The Gohari crosses provided a considerable amount of interesting material relative to their behaviour in crossing.

Kothar[5] of Bombay has tried to produce a long stapled and high ginning hybrid. A strain of *kumpta* with a low ginning percentage (20) and a long staple (1″) was crossed with a strain of Neglectum Rosea with a high ginning percentage (36) and a short staple. The cross resulted in true breeding strains which combined the desired characters of both parents. In 1920 Kothar[6] crossed a pure strain of Dharwar American with the Sea Island cotton and found it possible to produce but the same quality of lint as Dharwar American of sea Island quality.

In Gujerat, in Southern areas of the Bombay Presidency, in Hyderabad and in parts of Madras the natural conditions enable a larger staple to be grown. The improvement of the fibre is a much more important matter here. Much has however to be done towards production of a long stapled cotton with maximum ginn-

ing percentage. At present three fourths of the cotton grown in this country is long stapled. Trought[15] and others have considered a rearing of successful cotton hybrid more different than in other crops. Thadani[13] made crosses between 4 F and Mead with the object of imprving the staple (7/6") of 4 F Cotton which seem to be the hardiest and most prolific cotton for Sind.

Tobacco :—The work of cross breeding Tobacco is carried on at Pusa and many promising results have been obtained. More than 51 types of Nicotiana tobacum ; and 20 types of Nicotiana Rustica L. are in pure culture. A hybrid between a pure deshi type (type 28) and an American Adcock has evolved a breed which is more suitable for export than the heavy dark type of leaf ordinarily.

Groundnuts :—New rapidly maturing, disease resistant types of Groundnuts were introduced in the early part of this century. The damage caused by the so called tikka disease is out of question now. Several Resistant types of pigeon pea have been isolated at Pusa. A close study of the linseed with a view to producing a strain of good yielding power and high oil content is in progress.

Barley :—Some cross-bred forms show promise of combining the high yielding of type 21 parent and the white colour of the seed of the other parent and may thus furnish material for producing a good type of Malting barley. Wilt resistant Rahar, and high yielding Hemp and gram are also some of the achievements of the workers at Pusa. Balaji Rao[1] observed Rartial sterility in the first generation plants of the cross between varieties of common eggs—plant (Solanum melongina).

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COW TESTERS' CLASS

The Gopalak Sangh, Sholapur, opened a short time class of "Cow Testers" from the 9th to the 16th November, 1934. This class is the first of its kind in India. The workers of the Gopalak Sangh, Sholapur, saw that the institutions of Cow-Testers have improved the lot of the cow in Europe and America, and that an effort on similar lines suited to Indian conditions and sentiments would be equally beneficial. With this object, a curriculum of studies was prepared with the aid of the Principal and Professors of the Agricultural College, Poona. Experts on each subject residing at Sholapur were approached, and six hours training per day was given to 47 students for eight days on Cow-testing, Dairy farming, Breeding, Dairy management, Care and marketing of milk, Cattle diseases and their cure etc. In the end after examination certificates were given to 40 successful students.

ALKALI SOILS*

S. C. CHOWDHURY.

III

Reclamation of Alkali Soils

The methods employed in reclaiming alkali soils may be divided, for convenience, into the following heads :—

(1) *Methods of Temporary Control:—*

(a) Cultivation.

(b) Growing of resistant plants.

(c) Removal of alkali salts.

(d) Chemical correction.

(2) *Methods of Permanent Relief.*

(a) Adequate lowering of the water table.

(b) Washing excess salts out of the soil—irrigation, under-drainage and leaching.

(c) Assuring easy and sufficient drainage after natural precipitation and irrigation.

(d) Careful management of the reclaimed land.

Methods of Temporary Control.

Cultivation.—Any method of cultivation that lessens the rate of evaporation from the surface of the soil will help to prevent the accumulation of alkali. Surface mulching, frequent cultivation, application of manure, and the growing of plants that shade the soil, all tend to reduce evaporation; and when there is any alkali in the subsoil which would tend to come to the surface, these methods will either delay or entirely prevent its rise. Such measures must be considered as preventive rather than remedial, for when alkali has already accumulated at the surface mere cultivation or mulching will not ordinarily insure the growth of crops.

When the alkali is all accumulated at the surface of the ground and is not in too large quantity, it is often possible to grow crops by deep ploughing and frequent cultivatition. Deep ploughing turns the alkali well into the soil and mixes it with such an amount of soil as to dilute the crust and render it less harmful. Frequent cultivation then prevents the rise of alkali to the surface until the crop has had time to establish itself and grow beyond the very tender period.

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*The first two parts of this article have appeared in the January and March 1935 issue of the "Allahabad Farmer."

Growing of Resistant Crops.—Some crops that are of great use to man are more or less resistant to alkali salts and undertaken with profit.

The growing of resistant crops on alkali land is always attended with risk, for should there be any change in the existing conditions a further rise of alkali may bring to the surface more salt, preventing all growth. In the Central Valley of California, where drainage has not been attended to, orchards are frequently damaged by alkali. Alfalfa is then planted because it can withstand more salts than the tender varieties of fruits. Further increase in the amount of salt causes the loss of the alfalfa and the owner resorts to Bermuda-grass; this in turn gives way to salt grass, and that eventually succumbs, leaving the ground bare or supporting a few alkali weeds.

The statement is often made that some crops can be grown, such as sugar-beets, that absorb so much alkali that they will in a few years remove sufficient salt to permit the growth of any crop on the land. An ordinary crop of sugar-beet will remove less than 2,000 lbs of alkali salt from an acre, and when the amount of salts is placed at the extreme limit of one per cent of the soil, it will require ten years to remove sufficient alkali to permit the growth of the more tender plants.

Lands heavily charged with alkali have been farmed profitably by the use of such crops as sorghum and kafir corn. In Arizona land is deeply furrowed; water is run down the furrow and sorghum is planted at the bottom of the furrow. The alkali creeps up on the ridges and there remains while the roots seek the soil under the furrow that has been washed free from salt.

In Egypt, where large arrears of alkali soils have been reclaimed successfully by drainage and flooding, a number of crops are grown during the process. The most important are rice, samar, Panicum Crus-galli and Egyptian clover. A crop that can endure large quantities of water and that can therefore be grown on alkali land during the course of reclamation by flooding, should be of great advantage since it would be so much gained if the land were producing something while it is being washed.

The crops at present most grown in the United States of America on alkali soils are barley and sorghum. It is recommended that for the reclamation of alkali soils, sorghum be seeded at the bottom of the furrows, and the crop be given as many heavy irrigations during the season as the abundance of the water-supply will allow. By then breaking down the ridges and flooding as often as possible during the winter and growing another crop of sorghum the second summer, land can often be reclaimed and made fit for the cultivation of other crops in two years.

Removal of Alkali Salts.

Scraping.—The alkali salts can be scraped up when they come to the surface and carted away. The expense of this is very great, and it is generally found that immediately a second accumulation forms by rise of the alkali yet in the subsoil. Such a method is faulty, because it does not remove the cause of the rise of alkali, and as there is practically an unlimited supply of the salts in the deep subsoil or being formed by the weathering of the soil particles and the decomposition of the salts in the soil—it does not give permanent relief. But this method of scraping land, if practised when there is an accumulation of salts on the surface of the soil, decreases considerably the amount of soluble salts in the upper surface of the soil. If heavy irrigation is then practised and the land deeply cultivated, alkali-resistant plants will thrive and make the land permanently culturable in a few years.

Flushing.—This is a very popular method, that of flushing water over the surface and washing away the crust of the salts at the surface of the soil. This method is of little value, because the first waves of water that run across the field dissolve the alkali crust, and it is absorbed into the soil, leaving the fresh water behind to pass over the land. As soon as the surface is dried, this absorbed alkali again comes to the surface to form a crust. This method is extremly faulty—it only makes a heavy loss of irrigation water and hastens the accumulation of salts at the surface.

Leaching :—There is a third method by which alkali salts can be removed partially and the land made fit for the cultivation of alkali-resistant plants—leaching the land. To leach soil there must be an outlet by which the water can escape,—that is, there must be good drainage. When the soil has a porous structure and the natural drainage is satisfactory, to bring the land into a sweetened and fertile condition it is necessary only to wash it thoroughly with fresh water. The salts dissolved in water pass through the soil and escape through the natural drainage or collect in the deeper layers of the soil where the plant roots do not penetrate: the alkali concentration is much lowered at the surface and the land made fit for the growing of crops.

Leaching has been found successful in diminishing the amount of alkali salts in alkali soils. But continuous leaching decreases also the fertility of the soil. In order to obtain some evidence of the general fertility of the soil and to learn the effect of extensive leaching on fertility, composite samples from the surface foot of the soil, when the experiment was started, and again after a years' treatment, were analysed by Prof. J. S. Jones. It was found that the sulphur and nitrogen content was reduced somewhat but otherwise leaching had little effect upon the fertility elements. The following table is intended to illustrate the fact:

Chemical Composition of the Soil before Leaching and after Leaching by Professor Jones

	April 1921.	September 1921.
K_2O	2·450	2·360
Ca O	3·450	3·620
Mg O	1·080	1·170
P_2O_5	0·242	0·237
S	0·041	0·028
N	0·040	0·034

Chemical Correction :—In an attempt to correct the inhibiting effect of alkali salts on plant life and soil, the agronomist tries to change the alkali salts chemically into a compound either in soluble in water or inert. There is no one method known by which all the alkali salts occurring usually in alkali soils can be completely made harmless to plant-life. But there are many chemicals known to-day to the scientist, a moderate application of which can make plant life possible even in a very bad alkali soil, though they are all temporary control measures.

Calcium Sulphate :—When the land is an alkali one even containing large amounts of sodium carbonate there is no reason to doubt the possibility of completely reclaiming the soil by the use of an adequate amount of gypsum and leaching out the soluble salts. This process, originally proposed by Hilgard, consists in applying calcium sulphate to the soil. The suiphate of lime reacts with the sodium carbonate to produce sodium sulphate and calcium carbonate; the latter compound is the well-known limestone, beneficial to soil, and the sodium sulphate is relatively much less harmful than the carbonate. The reaction is as follows :—

$Na_2\ Co_3 + Ca\ So_4 \longrightarrow Ca\ Co_3 + Na_2\ So_4$. For each part of sodium carbonate, 1·3 parts of sodium sulphate will be formed. One-tenth of one per cent of Sodium Carbonate is too much for ordinary crops; the change into sodium sulphate will make 0·13 per cent of sodium sulphate, or less than one-third the amount of that salt necessary to injure plants. Thus when the black alkali is unaccompained by harmful quantities of other salts gypsum will be found effective in reclamatlon.

For the reclamation of alkali soils large quantities of calcium sulphate are required. The following table shows the quantity of gypsum required to neutralise sodium carbonate in an acre-foot of soil :—

Table V.

Quantity of $CaSO_4$ required to neutralise Na_2CO_3 in an acre-foot of Soil. An acre foot of Soil weighs—4,000 000 lbs.

Per cent Na_2CO_3.	$CaSO_4$ per acre-foot lbs.	Per cent Na_2CO_3.	$CaSO_4$ per acre-foot lbs.
0·01	640	0·06	3840
0·02	1280	0·07	4480
0·03	1920	0·08	5120
0·04	2560	0·09	5760
0·05	3200	0 10	6400

World over, gypsum has been tried in the reclamation of alkali soils. It has been found to give satisfactory results only when the alkali salts were composed largely of sodium carbonate. When the black alkali was accompanied by other salts the change in kind of salt brought about by calcium sulphate left more white alkali than the plants could possibly stand. The economic use of gypsum is therefore not without reservations. The value of gypsum in the reclamation of alkali soils will be evident from the following tables :

Table VI.

Expts. with $CaSO_4$. Reclamation of Alkali Soils. California Expt. Station. Crop yields in lbs per acre.

Plots.	Treatment.	Tons per acre.	1920 Barley Hay.	1922 Barley Hay.	1923 Melilotus indica and cowpeas.	1924 Melilotus alba.	1925 Alfalfa.	1926	1927 Alfalfa.
3	$CaSO_4$	12	875	2154	2438	Ploughed under	5422	Uncropped.	10,728
4	$CaSO_4$	15	696	2865	3216	as green-	5955		11,742
5	..	..	1428	1770	2584	manure.	3585		6,255

NOTE.—Barley, Melilotus indica and Alfalfa can resist alkali to some extent. See "Plant in Relation to Alkali Soils". Alkali Soils—Part II.

Table VII.

Expts. with $CaSO_4$. Reclamation of Alkali Soils. Oregon Expt. Station. Yields of Rye Hay in lbs.

Plot.	Treatment lbs. per acre.	Yield lbs. per acre.	Sweet clover seeded. Results as follows.
J	6800	545	Scattering Stand.
K	13600	550	Good Stand.
L	20400	810	Excellent Stand. Thrifty plants.

The use of gypsum for the reclamation of alkali soils is restricted due to its high price and the enormous quantity that is required for reclamation. It has been found that drainage, if properly done, can free the land of both white and black alkali at less expense than by the application of gypsum. In localities where gypsum can be obtained cheaply or where the amount required is not very large, it will be found effective and profitable as a treatment for black alkali. The effect of gypsum is seen in the greatly improved tilth of the land, as well as in the absence of the corrosive action on plant tissues.

Sulphur :—In connection with his work on sulphofication, J. G. Lipman suggested that sulphur might be effective in decomposing sodium carbonate in soil. Elemental sulphur when applied to the soil is oxidised by biological activity mainly and combines with water to form sulphuric acid which actively combines with the basic materials in the soil. Investigations have pointed out that applications of sulphur resulted in the decomposition of sodium carbonate, and that probably combines with the complex sodium silicates, which are held to contribute markedly to the impermeable condition of black alkali soils.

The following tables are intended to give some clue as to the possibility of decreasing the quantity of alkali salts in soils :

Table VIII.

Effect of Sulphur Treatments on the Alkali contents of Soils Oregon Expt. Station.

Treatment.	lbs. per Acre.	Total Salts.	$Na\ CO_3$.	NaNl.	$Na_2\ SO_4$.
Check before treatment Six weeks after treatment.		2060	847	117	1096
Sulphur	1000	2710	429	154	2127
Do.	3000	3064	195	116	2753
Do.	500	1462	225	132	1105

Table IX.

Effect of Sulphur and Gypsum-Crop yield in pounds per acre, Calif. Expt. Station.

Plot.	Treatment.	Amount per acre.	1921 Barley Hay.	1922 Barley Hay.	1923 Melilotus indica and Cowpeas.	1924 Alfalfa.	1925 Alfalfa.	1926 Alfalfa.	1927 Alfalfa.
11	Sulphur	3600 lbs.	145	300	Ploughed as green-manure.	4000*	18467	23658	20, 138
11	Gypsum ..	10 tons.	430	1815		1500*	12838	14368	15, 03

*Yield from a single cutting in September.

Inoculated Sulphur.—In the Oregon Experiment Station sulphur was finely ground and inoculated with a culture of Sulphur oxidising bacteria. This was applied at the rate of about two tons per acre. In addition to sulphur, gypsum and ground limestone were applied at the rate of 2·5 and 2 tons per acre. They were sown to melilotus alba. Fairly good growth was obtained on each of the sulphur treated plots but the seed failed to germinate on the check plot. The melilotus alba was ploughed under as green manure and alfalfa sown. As shown in the table heavy yields of alfalfa have since been harvested from these plots :

Table X

Effect of Inoculated Sulphur on Alfa fa. Oregon Expt. Station

Treatment	Tons per acre	1925 Hubam clover	1926 Alfalfa	1929 Alfalfa
Sulphur and gypsum .	2 and 2·5		10,916	17,549
Sulphur and Lime ..	2 and 2		11,500	18,897
Untreated	..	Ploughed under as green manure	83	615
Sulphur	2		12,166	18,848
Sulphur	2		9,583	17,031

Iron Sulphate and Alum.—Laboratory experiments by Professor Kelly and Thomas gave results which indicated that iron sulphate and alum might produce effective results in the reclamation of alkali salts. Alkali soils were treated with ferrous sulphate and alum and heavily flooded. Barley was then planted. The seeds germinated well and the barley seedlings grew vigorously for a few weeks on each of the treated plots. Later the plants became pale in colour and the yield was low. Cowpeas were then planted; they germinated well on both the plots but later the plants became pale and unthrifty on the alum plots. Barley was then again grown; the yield was low. Alfalfa was then planted. The seed germinated well and the subsequent growth was normal in appearance. The untreated check plot remained almost entirely unproductive, whereas the iron-sulphate and alum plots gave good yields of alfalfa.

Table XI

Effect of Iron Sulphate and Alum. Reclamation of Alkali Soils. Yield in lbs. Professors Kelly and Thomas

Treatment	Tons per acre	Barley 1923	Barley 1924	Hubam clover 1925	Alfalfa 1926	Alfalfa 1927
Untreated		528	192	Ploughed	60	618
Iron Sulphate*	9	2,406	1,101	under as	11,880	19,176
Alum	11	1,014	801	green-	10,320	18,762
Iron Sulphate†	5	..		manure	12,739	20,504

Aluminiun Sulphate.—Scofield and Headly have reported results from the use of aluminiun sulphate on the impermeable black alkali soils. Aluminium sulphate has been used in the Vale Experiment fields in amounts varying from 500 lbs. to 5 tons per acre. Little or no benefit resulted from 500—1,000 lbs. or the 1 ton and 2 tons applications, but the application of 5 tons per acre resulted in a decided improvement. It yielded a vigorous and a thick stand of sweet clover. The improvement in the physical condition and the rapidity of obsorbing moisture were also very great and marked.

Manure.—Attempts have been made to reclaim alkali soils by the application of farmyard manure by a number of investigations. Manure has not been found capable of decreasing the alkali content of soils. When applied alone it has resulted in an apparent improvement in the tilth and permeability of the soil. The use of manure in combination with sulphur and ground limestone and gypsum has been decidedly beneficial. These conditions result in a temporary improvement of the alkali soils, particularly in the surface three or four inches, and often make it possible to grow crops on land so treated even if the reclamation is not complete and permanent.

Table XII

Treatment of Alkali Soils with Ground Limestone and Manure. Yields in lbs. per acre.

Treatment	Amount per acre	Barley 1923	Barley 1924	Hubam clover 1925	Alfalfa 1926	Alfalfa 1927
Manure and Sulphur	18 tons and 1,000 lbs.	0	24	Ploughed under as	10,440	20,022
Sulphur and ground limestone	1,000 lbs &	108	30	green-manure	1,800	11,634
Untreated ..	9 tons	0	15	..	312	2,502

*Applied in June, 1922.

†Applied in October, 1925.

General Discussion on Chemical Correction.—Gypsum, iron sulphate, alum and aluminium sulphate have been found to produce beneficial effects on alkali soils but at different rates. Gypsum brings about these changes because of its soluble calcium while the effect of sulphur, iron sulphate and alum is due to their acidic nature in consequence of which the alkali salts are decomposed. Ferrous sulphate and alum react with the soil most quickly because of their high solubility and acidic nature. Sulphur acts most slowly for the reason that this material must undergo oxidation before it can produce any important effect on the soil. But when inoculated sulphur is applied the reaction takes place earlier.

Sulphur has proved to be much more economical than the other materials. Large yields of alfalfa have been produced on soil that was badly affected with alkali and entirely unproductive at the outset by applying one ton of sulphur per acre. When used in conjunction with stable manure 1,000 lbs. of sulphur per acre has given good results.

Alkali soils of all types can be treated successfully with sulphur but it is certain that the amount of sulphur required for the best results will vary in different localities depending on the nature of the alkali salts. Generally speaking, heavy black alkali soils will require more than light white alkali. In connection with the use of sulphur it is important to bear in mind that a period of several months, perhaps a year or more, will be required before the full effects will become manifest. Sulphur must undergo oxidation before it can produce any beneficial effect, and the oxidation is a relatively slow process.

It seems desirable to mention that sulphur is not recommended for any and all types of alkali soils. At present it can be safely recommended only for those soils that contain large amounts of replaceable sodium. Sulphur should not be used where the soil contains a considerable amount of soluble calcium salts.

In all cases of chemical correction cost should be taken into consideration and adequate attention paid to proper drainage. Treatment will be commensurate with the cost on any alkali soil unless the drainage conditions are favourable and unless the ground water level can be kept down continuously to a depth of 10 or more feet, below the surface of the soil. Whatever material is applied, the land should always be cultivated to a crop, preferably a legume, and the evaporation from the surface soil retarded by proper cultivation, shading and mulching.

Methods of Permanent Relief.—There is only one way of reclaiming alkali soils permanently. It requires four essential steps :

(1) Adequate lowering of the water-table.

(2) Washing excess salts out of the soil.

(3) Assuring easy and sufficient drainage after natural precipitation and irrigation.

(4) Careful management of the reclaimed land.

Adequate Lowering of the Water-Table.—In an attempt to make a land permanently free from alkali the first attention should be paid to the water-table. In many cases lands that have been discarded for being unproductive due to accumulation of alkali will be found improved for ordinary crops only by a lowering of the water-table. This does not mean that the water-table need be lowered only for a short-time during the growing season of the crop—rather it means a permanent lowering by means under the farmer's control so that a rise of water above a given elevation in the soil for any length of time may be wholly prevented. The first step in lowering the water-table is to learn the source of the water that cause it to rise. In isolated cases on small tracts it is comparatively easy to find the water source and cut it off by the construction of one or more intercept ditches. In most cases, however, a few large open drains with a network of covered tile drains will suffice. In some cases lowering of the water-table may be accomplished effectively and economically by pumping water from the underground sources.

Washing Out Excess Salts.—Flooding water over the surface of the alkali soil is not an effective means of reducing the salt content of soils. It is usually essential that large amounts of water be applied to alkali soils and made to percolate through the soil in order to leach out the excess salts. Coarse-textured soils of open structure, as a rule, have sufficiently high permeability to make leaching of excess salts a comparatively simple task, after the water-table has been sufficiently lowered. Unfortunately, however, fine textured compact soils of low permeability do not allow water to pass freely through them. So the permeability of such soils should be first increased by the use of chemicals.

Washing out of the salts from alkali soils is best accomplished by building up dikes around the land, in as large areas as possible, and covering with water to a depth of five or six inches. This is allowed to soak in and a second flooding applied, and so on until the land is sweetened. Occasional stirring of the soil between floodings will help to prevent puddling and hastens the leaching of the salts. If some crop can be grown that will stand almost constant flooding, it will help the reclamation by keeping the soil in better physical condition. There are a few crops that permit heavy flooding, such as rice, leptochloa fascicularis, panicum crus-galli and certain sedges.

Drainage After Rain and Irrigation.—The soil should be drained completely after rain and irrigation. The large tracts of alkali soils that are found in India and California are largely due to their irrigation systems carried out without any provision being made for drainage. When lands are irrigated from high-level canals, without any provision being made for drainage, the result is that the water-table is soon brought nearly to the surface of the land. With this rise of subsoil water, the alkali crusts form at the surface and soils become unproductive even before expensive irrigation systems. Adequate drainage is, therefore, not only necessary in washing out the salts but is also essential in getting rid of the excess water after a heavy shower and irrigation.

Management of Reclaimed Land.—When in an alkali soil the water-table is adequately lowered, good provision is made for drainage and the excess salts are washed out, one erroneously concludes that the task of reclamation is complete. Complete reclamation is attained only when the lands are made to produce large crop yields. Usually the restoration of the full productive capacity or its establishment in case of an alkali soil that has been properly drained, the water-table sufficiently lowered and the salts all washed out, depends mostly upon its management after reclamation. Liberal applications of barnyard manure, ploughing under of green crops, avoiding of ploughing land when it is too wet, retardation of evaporation from the surface of the soil, use of large quantities of irrigation water sufficient to wash out the salts of the soil but insufficient to raise the water-table, keeping drains open and in good repair—these and other less important precautions are necessary and essential for the proper management of alkali land.

Efforts at Alkali Reclamation : Alkali land reclamation has probably been entered into more systematically in Egypt than in any other country. Nearly 250,000 acres of land charged with alkali have been returned to a fertile condition in that country in ten years. The establishment of drainage and leaching by heavy flooding has returned large areas to a fertile condition, and there are now beautiful fields of cotton, corn and clover returning as much as $75 per acre each year in rent, where ten years ago nothing would thrive but the most worthless saline vegetation.

In the United States of America extensive areas of land unproductive due to an accumulation of salt have been made productive by easy and economical methods of reclamation. In 1902, the Bureau of Soils of the United States Department of Agriculture inaugurated a series of demonstrations in the following tracts of land—Salt Lake city, Utah, Fresno, California, North Yakima, Washington, Tempe, Arizona ; and Billings, Montana. These tracts of 20 or 40 acres were prepared for basin irrigation, and tiles were laid at 50 to 200 feet apart and three to five feet in depth,

depending on the character of the soil. Large volumes of water were used in irrigation and everything was done to facilitate the leaching of the soil.

The original soil in these tracts contained over 2 per cent. of alkali salts to a depth of four feet, and that at the beginning of the experiment there were only three acres containing less than 0·4 per cent. of alkali in the first foot. After two years irrigation all of the land contained less than 0·2 per cent. of alkali in the first foot, and there had been removed from the tract 87 per cent. of the alkali originally present. The cost of tile draining was about $16 per acre. Other expenses chargeable to reclamation were, hire of man for irrigating six months each year at $40 per month and two ploughings at $1·50 per acre each. The total expense of reclamation, therefore, was $31 per acre. The land just before reclamation was sold for $8 per acre, and at the end if the experiment was worth $75 to $100 per acre, an increase on value of $67 to 92 per acre, brought about by the use of $31 per acre.

In India, no systematic attempts have been made to reclaim alkali lands. It is true that a few experiments have been carried out here and there, but unfortunately they have failed to meet the desired end. Will India follow Egypt and America and make thousands of her barren acres fertile and clothed with green verdure?

IV.

Alkali Spots.

Alkali spots are the characteristics of the soil of the semi-arid regions. They are the occasional occurrence of small patches of alkali varying in sizes from a few square yards to "several acres."

The Salts.—The alkali is usually white, being composed largely of sulphates of magnesium, sodium, potassium and calcium; chlorides of sodium and potassium and some nitrates. These alkalis or soluble salts do not usually occur in sufficient quantities to prevent completely the growth of crops in times of good rainfall but in periods of drought the concentration of the salts and the compact condition of the soil which they help to produce, give rise to conditions so unfavourable to the crop that it is very likely to succumb either because of the alkali alone or because of the combined effect of alkali and draught.

The alkali spots are more common on heavy soil than on light. Land that has alkali spots is likely to be good, aside from that objection, and when the effect of the alkali has been sufficiently mitigated, the land is usually very productive.

Treatment of "Alkali Spots".—The handling of alkali spots is not so difficult as that of the larger and more strongly impregnated tracts found in arid regions and irrigated tracts. There are a number of operations that may be applied with profit to these soils:

(1) Deep ploughing is always desirable, but it should never be done when the soil is very wet.

(2) One of the simplest and most effective methods of treatment is ploughing under fresh farmyard manure or other coarse and easily decomposable organic matter. This lessens the compactness, produces humus, and promotes drainage.

(3) As thorough drainage as possible should be secured by means either of tile drains or open ditches.

(4) Certain plants are more tolerant of alkali than are others, and they absorb large quantities of salts which are removed from the soil when the crop is harvested. Sugar beets are for these reasons one of the best crops for alkali land, and can be raised on most alkali spots. Alfalfa and brome-grass will also be of service on such soils.

(5) Constant cropping will improve the alkali spots regardless of what the crop is; Moisture should evaporate through plants, not directly from the soil.

(6) During the growth of plants the surface soil should be thoroughly stirred and the whole land ploughed when no crops are on the land.

(7) Fall ploughing is desirable unless the soil drifts, because alkali soil has a tendency to compact and thus aerate inadequately. By ploughing in the fall a better opportunity is given the soil to weather.

V.

Summary.

(1) Field experiments in different parts of the world have shown that the crop producing power of alkali soils can be greatly increased by the use of gypsum, sulphur, iron sulphate, alum and aluminium sulphate provided the materials are applied in sufficient amounts.

(2) The unproductivtiy of the alkali soils is due to the accumulation of an excess of soluble salts and the abnormal physical condition of the soil. The reclamation of the alkali soils must

involve the removal of the soluble salts and improvement of the physical condition of the soil.

(3) Among all the chemicals used in the reclamation of alkali soils sulphur has been found to give the most satisfactory results and it has also been found more economical than other materials.

(4) Leaching experiments without the application of any other material for the purpose of converting alkali salts into more soluble forms have thus far failed to bring about a satisfactory reclamation of the alkali soils.

(5) In adopting methods of temporary control, the alkali soils should be deeply cultivated, the salts partially removed, by heavy irrigations, the salts converted into less harmful compounds by the use of chemicals, and the land grown to alkali-resistant crops.

(6) There are many plants known which can tolerate the presence of varying amounts of alkali salts in soils. They should be always planted to alkali soils—they remove large quantities of salts with them and decrease evaporation from the surface of the soil, thus retarding the accumulation of salts at the surface.

(7) Experiments have shown that there are enormous possibilities of developing different strains and breeds of plants which will be able to tolerate large quantities of salts in the soil.

(8) When a permanent reclamation of the alkali soils is called for, the water-table should be first lowered sufficiently, then an elaborate system of drains laid out, then the soil heavily irrigated and the salts leached out.

(9) The reclaimed land should be very carefully managed. The land should be properly cultivated, the water-table kept constantly low, the drains clean and capable, the fields heavily manured and evaporation from the surface always checked.

(10) In devising any method of reclamation of alkali soils due attention should always be given to probable expenditure and the possible returns.

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The number of farms reported in the 1930 census of agriculture in the United States was 6,288,648.

RURAL MARKETING IN INDIA

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That rural marketing is the crux of the whole question of rural prosperity and betterment has been the correct diagnosis made by the Royal Commission on Agriculture as well as Banking Enquiry Committees, which have examined the conditions in the rural areas with great thoroughness and anxious care. Any one conversant with the conditions under which the raw produce of India is being marketed, cannot but have come to the conclusion, that immediate and correct solution for the Agricultural community in India is needed. It is only recently that this realisation has dawned upon the Agricultural and the Co-operative Departments.

It has been seen and experienced everywhere that the producer of raw materials and food-stuffs generally has failed to claim his fair share of the good things of the world, and this is very true at the present time in India, where farming is carried on by small units unassisted by any special organization for their protection. There was a time when the Indian farmer practiced subsistence husbandry and enjoyed the protection of the old village organization; but conditions have completely changed to-day, and the old archaic organization has ceased to be serviceable. As the Agricultural Commission has put it "His interests have in the main been left to the free play of economic forces, and they have suffered in the process, for he is an infinitely small unit as compared with distributors and consumers of his produce, who, in their respective fields become every year more highly organized and more strongly consolidated." (Para 320).

The opening and establishment of wide and competitive markets and the consequent commercialization of strong organization, though there has been no fundamental change in the organization of the Agriculture industry has been the result. Cultivation on small scale by small farmers is still the normal arrangement. The old immemorial agricultural methods and technique still remain largely unaffected. The agricultural credit mainly depends upon the village money-lender. THE Indian money-lender normally takes shelter from the door of the money-lender to whom his crops are often mortgaged in advance. Short term loans, which are often urgently required for the purchase of seed, etc., when the weather is favourable for sowing or for some domestic ceremony and for which substantial and tangible security is not available are in many cases accompanied by conditions such as sale to the money-lender of the coming crop at low price. "The system of advances

on crops which is prevalent in many parts of India has a very intimate bearing on marketing. The advances not only carry high rates of interests but they also put the borrowers under an obligation to sell the produce for less than they would have got if they would have been free to market the produce themselves." Besides these money-lenders there are many professional dealers and middlemen who attach themselves at every point and create a 'Comfortable corner of nourishment' for themselves at the expense of the cultivators. There is a long chain of middlemen. Even if we do not go into the extreme cases put before the Royal Agricultural Commission by the Indian Central Cotton Committee, there are usually too many intermediaries between the agriculturists and the consumers such as the agriculturists and local agent, the mofussil purchasers agent, mofussil purchaser and retail purchaser. Another disadvantage to which he is subjected is an insufficient provision of roads, bridges, and feeder railways—a fact which makes him unable to deal directly with the consumer or the wholesale dealer. His inability to dispose of his produce as and when he likes, and the compulsion from his own economic position to sell off earlier at a disadvantage than he would like, or at a moment when every body is likewise selling, and the market is glutted and above all the demands of Government Land revenue, the pressure for the Shahookar and need of the ready money to meet rent—all these solid facts causing financial pressure owing to his chronic shortage of capital—are evil features of the present time which compel farmers to release their produce in an overfed market for what it will fetch. It is no wonder under these circumstances, that he does not get a fair price for his produce. Not only is the agricultural producer thus unable to receive full competitive and just price, but he is also penalised and subjected to many hardships in other ways. "Scales, weights, and measures are manipulated against him, a practice which is often rendered easier by the absence of standardised weights and measures and of any system of regular inspection. Deductions which fall entirely on him but against which he has no effective means of protest, are made in most markets for religious and charitable purposes, and for other objects. Large samples of his produce are taken for which he is not paid, even when no sale is effected. Bargains between the agent who acts for him, and the one who negotiates for the purchaser, are made secretly under a cloth and he remains in ignorance of what is happening. The broker whom he is compelled to employ in the larger markets is more inclined to favour the purchaser with whom he is brought into daily contact than the seller whom he sees very occasionally." Again even after the prices are settled at the time of weighing, the price is still further cut down by refusal to take delivery on the plea that the stuff is of inferior

quality. The smallest excuse is sufficient enough for the purchaser to raise difficulties about the quality and reduce the price. If the poor fellow does not accept the abatement in the price he has to incur, again the cost of carriage and loading as the commodity has already been unloaded. The price which he may not be willing to accept, he is compelled to do so by adverse circumstances to which he is put.

Another handicap to which he is subjected, is that he has no incentive to grow the improved varieties introduced by the agricultural department. The market is levelled down to the common quality and is so insensitive to quality, that he cannot get a superior price for a better quality. As a result of this, various abuses exist, such as admixture not only on the threshing floor but also in the godowns of brokers and dealers. This is not only true in the case of cotton but other agricultural produce also comes on the market in a dirty and adulterated state, notably such articles as milk, ghee, hemp, wheat, etc. It is no place for me to propose to discuss the circumstances of each case, but it is important to call attention to the fact that it is the cultivator who is the ultimate loser if the marketing of agricultural produce is conducted on inefficiency and fraud. Such are the disabilities under which the cultivator labours in selling his produce in a market. The result that the cultivator does not hope to obtain a square deal owing to the absence of legal protection from unauthorised deductions, false weighings and unduly low quotations—practices made possible by the ignorance and lack of bargaining power of the cultivators.

All this clearly shows that the cultivator's position is extremely weak as a seller. Even if he may derive additional benefit in the form of increase in produce by resorting to intensive cultivation and other technical improvements, that would be eaten up and absorbed by his weakness in this direction. A cultivator may be efficient as an agriculturist, but would suffer if he is lacking in the art of disposal of his produce.

Such is the acuteness of the problem, the fact that India herself is the main market for her agricultural produce, makes the marketing problem a very important one. The value of total agricultural produce of British India amounts to about Rs. 1,300 crores. Out of it, exports of agricultural produce amount to about Rs. 200 crores.

The Agricultural Commission had strongly emphasized the need for undertaking marketing surveys and for the training of necessary personnel. The appointment of expert marketing officers under the Agriculture Department in each province is the

(*Continued on page 149*)

KEEPING MILK GOATS IN INDIA.

By J. L. Goheen, B. A.

Chapter VI.

Diseases and their Treatment.

It is probably largely because goats themselves are such clean animals, preferring clean food and quarters, to spoiled food and dirty quarters, that they are generally so free from diseases or ailments of one kind or another. And it is largely because man, in his care of these animals (or perhaps more truly lack of proper care), does not see to proper cleanliness or sanitation, ventilation, etc., that goats do occasionally suffer from a comparatively few ailments.

Now, one must learn to take a constructive attitude towards this matter of disease, or bad health. One must never forget, that it is far easier, in the long run, to keep one's animals healthy and strong, than to cure or even attempt to cure animals that have become sick. In other words the old proverb, "an ounce of prevention is worth a pound of cure" is very true, that we do not take to heart the fact that the cost of trying to cure sick animals, both in money, effort and time, not to say worry and concern, is generally so great, that we only learn the truth of this old saying after we have suffered from sad experience.

But why suffer that sad experience when it all might be avoided by learning to co-operate with the goats in keeping strong and well? 'Dirt breeds disease' and filth and foul quarters bring on trouble and sorrow, both for human beings and domestic animals. The goat would like to eat clean food and stay in clean, well-ventilated quarters, and he would like to have an occasional bath in warm sunny weather. Then why not co-operate with him or her in this matter of enjoying good health?

This fact of the preventing disease through proper care is so very important that it must be WRITTEN LARGE and CLEAR and kept constantly before one's mind so that it may never be forgotten. The people of India must learn to co-operate with each other, with nature, and even with their domestic animals, such as goats, in this most important matter of cleanliness. It is only by so doing that much loss from diseases can be avoided and many pests that attack both animals and human beings can be kept away.

At this point it is necessary to emphasize another principle that is very important in the care of one's goats, and that is whenever any goat becomes sick, it is advisable to remove it from the others and keep it in some quiet, separate, well-ventilated place by itself. If the trouble is only a wound or some such injury, such

removal may not be necessary, but if one is not sure just what is wrong, it is far better not to take any chances, but to take it away as soon as possible. For this purpose it is desirable, that there be some special room or place to which sick goats can be taken. If no such room is available, a special place under some shady tree or in the corner of some verandah, where not too much sun will shine and where there will not be a strong breeze, should be chosen, and good arrangements made for the sick goat or goat there.

When watering sick animals, the vessel in which the water is offered to them should not be used for the other goats, and one should be most careful about keeping one's hands, feet and clothing very clean when attending the other goats, after one has perhaps first attended to the sick one. A number of diseases are spread simply by the touching of articles that have come in contact with the sick animal. It is because of this that separate quarters and special vessels for feeding and watering, and the keeping of one's hands, feet and clothing so clean, are necessary. And even in the treatment of wounds, cleanlines is very necessary of course.

Still another point that needs to be emphasized is this, that sick animals often are not able to eat or digest the feeds that healthy animals are able to eat and digest. Not only that, but because they are likely to be weak, they will require more frequent feedings, but much less at a time. As they begin to feel better and regain their strength, they will be able to eat more substantial feeds, but until that takes place it is more waste of food and money to offer them the usual feeds. They must have nourishing food that can easily be digested, and that only in small amounts, but at rather frequent intervals. Just as this is true of human beings, so it is true of sick goats.

In short, sick animals require good nursing and attention, because so very much depends on such care to make them well. Many people have the idea that simply the dosing with medicines will be all that is necessary, but that is not the whole thing by any means. Very often the care that is given to sick animals may prove to be far more important than the giving of drugs or medicines. This all goes to show how very important it is to keep the animals well and strong. If one has to look after a sick goat or goats, the chances are that one may not have so much time to attend to those that are well, and yet it will never pay to neglect them. One must depend upon them for the daily supply of milk, and for future income. Why then allow sickness and disease, any opportunity to enter one's herd?

If there is sickness or disease or any kind in the neighbourhood, one must be most careful not to permit one's goats to mingle with other goats, or even to graze or roam about where any such sick

goats have been. It will be far better to keep one's goats tied in their stable and to take special pains to provide them with fresh clean food and water and for exercise to turn them loose in the run or runs adjoining their quarters. A little money spent on the objects mentioned in Chapter IV, such as stumps of trees or rocks, or even old boxes for the goats to climb and jump on, will mean that they will play and get good exercise, and one will not run the risk of having the disease in the neighbourhood attack one's herd.

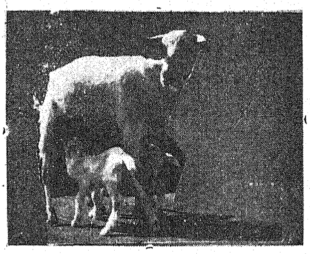
Now, in a small book like this, it will not be possible to go with very much detail into the subject of the several diseases or troubles with which goats are affected. It is the intention to treat only of the most common ailments that affect goats, and that perhaps at not great length. That is why so much emphasis has been placed on the subject of Prevention of Disease, that in addition to what has been said above. In the Marathi language there is a very good book on the subject "A Manual of Cattle Diseases", and so much that has been stated in that book is applicable to diseases and ailments of goats because very many of the troubles that bother cattle are found to be common to goats. It is true that goats are smaller animals, hence the amount of medicine required for the treatment of cattle, as indicated in that book, will be too much for goats. It will be safe to go on the understanding that one quarter of the amount mentioned for cattle will be sufficient for adult goats. It is recommended however, that all goat keepers should get a copy of that book and use it. The descriptions given are very good and one can get much help from it.

In the English language there are several books that may be had, a list of which will be given in the English edition. However, whether one has books or not, if there is a veterinary doctor in the neighbourhood and one has any trouble with one's goats it would be well to consult him at once, taking along the sick goat or goats to the dispensary so that he may see them at first hand. Such expert aid there may not be available in all places, but wherever it is available, it should be carefully followed. Do not delay in securing such aid, for delay often means defeat and death. And this point applies to the treatment if one has to depend on one's self and one's books for aid. Try to find out at once what is wrong, and then begin at once to apply the treatment.

It is well to keep in mind also just what a healthy goat looks and behaves like. One will notice that its eyes are bright; that its coat of hair is sleek and smooth, or shiny; that it is active and has a good appetite; that its droppings are in the shape of little hard balls of dark brown colour and are passed at rather frequent intervals; that its body temperature is just about the same as that of human beings to the touch, (it is really higher by about 4

degrees but this is hardly noticeable); that it chews its cud while resting; and that it enjoys its exercise or time of grazing with a good deal of relish. These are some of the noticeable features of a healthy goat, and any departure from such looks or behaviour will give at least some indication of ill-health. One ought to form the habit of noticing one's animals very carefully each morning, and if one sees anything abnormal in the looks or actions of any one in the herd, care should be taken at once to separate that one and then examine it thoroughly to try to find out what is wrong.

The following diseases or troubles of goats will now be taken up; Pneumonia, Worms, Pox, Caked Udder, Indigestion, Diarrhoea, Constipation and Sore Teats. For their treatment it will be advisable to have on hand the following simple remedies:—Castor-Oil, Epsom Salts, Mustard Powder, Copper Sulphate (Blue Stone), Turpentine, Phenyle, Dried and Coarse Tabacco stems, and Iodine and Iodine ointment. All except the last two ought to be available without much difficulty and even the Iodine can probably be easily had in all bazaar towns today. Ordinary cooking oil (sweet oil) should also be available, but it is not specially mentioned as it is to be found in very household.



Pneumonia is one of the commoner and more dangerous of the troubles that attack goats. It may be the outcome of an ordinary cold, while it also may be induced by travel in a railway train under unfavourable conditions. The animal will have a high temperature, which may have been preceded by a chill. There will be loss of appetite, hard breathing, sometimes a cough, and the appearance of suffering. Such an animal should immediately be removed to some dry, warm place where there will be plenty of fresh air and no strong draughts. A piece of old sacking or some such warm material should be tied over its back and around the chest, and it should be kept warm and quiet. A paste made of mustard powder and water and spread over the back next to the ribs and under the body just behind the front legs, should be applied just as close to the skin as possible. In half an hour it should be removed. In order to keep it on, it will be necessary to tie it on with newspaper and then cover that over with the sacking very securely. It must not be allowed to remain longer than one-half hour, otherwise it will blister the skin.

A goat sick with Pneumonia will need very careful and constant nursing. It will want plenty of water to drink, and it will

be well to try to maintain its strength by feeding with warm milk with which a little thin wheat "Kanji" or porridge has been mixed. No dry or hard feeds should be given until it is practically well. A dose of Epsom Salts, one large spoonful to a quart (seer) of water, should be given every other morning and great care should be taken in keeping the place clean. Feeding of the soft or liquid nourishing food should be in small quantities and at rather frequent intervals. Careful nursing may bring about a cure.

Worms found in the digestive tract of goats may be of several different varieties. In fact, there are far too many different kinds, and all kinds are very troublesome. They all are due to lack of cleanliness in the feeds or quarters where goats are kept, or even sometimes to the contamination due to constant use of the same field or grazing plot. The importance of good sanitation and cleanliness in all that has to do with goat keeping can not be emphasized too much. Once goats are attacked by worms it is very difficult to get rid of them, even with the most careful treatment. They multiply rapidly and cause weakness, so that the animal may have a good appetite, but appears to become weaker and very sick, or else it may not appear so sick but have a rough untidy coat of hair, ribs showing and a swollen belly, eyes sunken, occasional attacks of diarrhoea, and a general attitude of weakness. If this trouble is worms, as it probably is, it must be checked, otherwise the animal will probably become weaker and waste away.

Now these worms do not always show up in the droppings because some of them, the stomach worms for instance, are quite small and not easily seen. The tape worms come out in pieces or segments and such small pieces may easily be hidden in the droppings. Round worms of goats are also small wily-looking, and cannot be noticed easily. And so, it may be possible to miss seeing any such enemies in the droppings. However, in order to make certain it will be well to collect some droppings and mix them in a small quantity of water, being careful to break up the pieces so that everything will be in solution. Then this mixture should be strained through some old cloth and spread out in bright sunlight. It will then be easy to see the worms, for they will be separated from the droppings. If one does not find any the first time, it will be well to repeat this process more than once, because sooner or later the worms are very likely to be found. Growing kids are especially likely to be bothered with worms, once they begin to nibble at grass or fodder. One should be very careful, then, to be on the look out for this trouble with them, especially if their growth does not seem to be normal.

For the treatment of this trouble one should take onehalf seer of coarse tobacco-stems and steep them (allow to boil very slowly)

in two gallons of water (half an oil tin) for 3 or 4 hours in the evening, and allow this solution to stand all night. In the morning the stems should be strained out and only the clear cool solution is to be kept. No feed or water should be given to the goat or goats the night before, because it is important to starve the worms also. Now, take one ounce (2½ tolas) of copper sulphate from which all white crust has been removed, break it into small pieces and dissolve it in 3 quarts (seer) of water. This should be done in an earthen vessel or a white enamel one, brass or metal vessels not to be used. Then equal portions of the tobacco solution and the copper sulphate should be mixed together.

A long-necked bottle is necessary now for the giving of this medicine. Put nine large spoonsful of the above mixture into it for a goat 2 or 3 years of age; for a goat one year old, 6 spoonsful will do; for one month old, 4 is the right amount, and for a kid 3 months old, 2 spoonsful is sufficient. The mouth of the bottle should be carefully inserted into the corner of the mouth of the animal, the neck being held over the tongue with the head of the animal held level, and the bottle itself also about level. The mixture must be given very slowly so that there will be no danger of choking, otherwise there may be very serious consequences. Nofeed or water should be given for 3 or 4 hours, but Epsom Salts should be given, one large spoonful to an adult goat and about half that amount to kids, the bottle to be used for giving it just as for the worm mixture. Probably a half hour or so after giving it worms will be found coming out in the droppings, all of which should be carefully removed and burned. Now, water to drink should be given and food supplied in the usual manner. After one month this treatment should be repeated, if there still seem to be signs of worms. The Epsom Salts mentioned above should be mixed in about two cups of water, for the adults, and one cup for kids.

Pox.—This disease is usually only found on the udders of goats that are giving milk, and that most frequently in the case of those that have but recently given birth to kids. Small swollen sores are found on the udders, and these usually break when a small amount of pus comes out and water scabs form. The udder becomes very tender, so much so that the goat may object to being milked. She also probably will develop some fever, and show signs of discomfort and restlessness.

From the nursing mother the disease may easily be spread to the sucking kid, sores of a similar nature breaking out about its nose and mouth, also perhaps on other parts of body. The one who milks may even get such sores on the fingers. But the disease is not a very serious one after all. The chief thing is to keep it from spreading amongst the other goats. Therefore, the udder

should be well washed twice a day, before milking time, with phenyle solution, and the milker should see to washing his hands in the solution before he touches any of the other goats. The sick goat should be kept in a separate place, and her udder should have a treatment of clean sweet oil each time after the milk has been drawn and it has been washed with the phenyle. A dose of Epsom Salts, such as was described above, should be given to her very carefully about twice a week until the trouble is over. Whether the udder is tender or not, the milk must be drawn, otherwise there will be danger of caked udder forming.

Caked Udder.--This trouble is most apt to affect goats that are heavy milkers, and that when they have but recently given birth. It may be caused by a blow on the udder but the most frequent cause is due to lying on cold damp ground. More recently there is some reason to think that the trouble may be inherited. In any case, it is a serious matter which requires very prompt and careful attention, otherwise a good goat may be spoiled for life. Another possible cause may be due to sudden death of the kid or kids, or sickness which prevents their drinking or sucking as they should. Under the last heading it was pointed out that all milk should be drawn off very carefully even when a goat may have sores or pox on the udder.

Close attention must be paid to the animal during the first two or three weeks after giving birth in order to see that there is no hardening or swelling of the udder anywhere. Generally at first there will be one or more small spots where this may be noticed, and at once prompt treatment must be applied. Otherwise the hardness will spread to one whole side, or even to the whole udder. It will then be most difficult to cure the animal.

As soon as the first signs are observed, the goat should be removed to some quiet warm spot, and hot water should be prepared, say about 3 seers. Into this a small spoonful of turpentine should be emptied, or else two large spoonsful of Epsom Salts, and soft heavy cloth should be secured for the purpose of wetting thoroughly with this hot solution, then wringing out the excess water and applying to the caked portion. The goat may not be able to bear the cloth too hot, but as soon as it becomes somewhat cool it should be removed and another hot one applied, it being held there with both hands. Occasionally a little rubbing of the udder with hot sweet oil should be done in between the applications of hot cloths. Also, slow gentle attempts to draw off the thick stringy milk should be made. It may be necessary to keep up this process for an hour or more each time, and it should be done at least twice and perhaps even more frequently each day. This is necessary if the goat is to be saved. In a case like this one must have deep pity for the goat.

After each period of treatment described above, the application of Iodine Ointment, if available, is advisable. This can be had in larger centres but not in villages. Failing the application of such ointment, one can prepare an ointment of turmeric powder and sweet oil, the powder to be in very fine condition, and just enough oil mixed in, to make a smooth salve. This should be put carefully all over the affected part, and then a warm clean cloth is to be tied over the whole udder, with a good supply of dry straw or grass for the goat to lie on, and she is to be kept away from cold or dampness. She should be fed at regular intervals with small amounts of easily digested feeds, and she must have good nursing all the while, in which case it may be possible to cure her.

Indigestion.—This trouble affecting the stomach and organs of digestion ought not to occur if feeding has been attended to properly. However, if there has been any sudden change in the make-up of the feeds or in their proportions, or if the goat has eaten something it ought not to have had, there is very likely to be trouble. In the hot season when the variety of feeds, especially when out grazing, is apt to be limited and when there is dirty stagnant water, and only that kind in the pools, one must be very careful when one's goats go out to graze.

When indigestion comes on, sharp pain develops, and the goat will roll on the ground, stretch itself and perhaps even cry out. Young kids will especially show much signs of distress. In their case this trouble may come on even from drinking cold milk. Hence it is important that motherless kids always be given warm milk to drink.

One of the first things to do is to put the animal in a warm place and apply dry hot cloths to the stomach, and prepare a half cupful of warm sweet oil, adding a small spoonful of turpentine, and give this to an adult animal, reducing the amount considerably for small kids. Rather than offer cold water, it would be better to prepare water that has been somewhat warmed for drinking. If the treatment needs to be repeated one should do so in 6 hours or so. If there have not been droppings, a liberal dose of warm castor oil, 2 large spoonsful for adult and much less for very small animals, will be beneficial. The warm oil will become thin, so should be given in a bottle with a long neck.

An animal suffering from indigestion should be fed carefully for some time. Feeds that are easily digested and which agree with the goat should be selected, and any changes that are to be made should be made gradually. There is a tonic mixture that can be prepared in larger centres in chemists' shops, and if one is able to secure this mixture it will be well to get and feed it. Look for it in Special Notes.

Diarrhœa.—Too much dampness, or too much fresh green feed in wet condition, or too sudden a change in the feeding will bring on this condition of diarrhoea. This trouble is closely related to Indigestion, and much the same treatment for adult goats is required. Warmth, a good dose of castor oil, and dry grass or fodder, with clean, fresh slightly warm water to drink, will generally bring about good results. At any rate, the amount of feed should be cut down so that the digestive system may have a good rest. It will be well to keep the affected goat in a separate place.

Young kids are subject to this trouble, and in their case one has to be very careful, cold milk, drinking too quickly, lack of cleanliness, also cold and dampness, irregularity, in feeding or eating too much because of too long intervals between feeding, eating too much, green grass especially after drinking milk—all these are causes which bring on the trouble.

The effected kid should be removed at once to a warm dry place and should be kept covered with a heavy warm cloth, especially if the weather is cold. For a small kid a small spoonful of warm castor oil, and for a larger one, two spoonsful should be given. It should not be allowed to suck its mother, but her milk should be boiled and a thin paste of browned fine wheat-flour should be cooked in this milk and this fed in small quantities, 4 or 5 spoonsful, every hour or so. Be sure to keep the kid warm and its place clean, and all feed given to it must be very clean and warm. When it is much better it may be allowed to take small amounts of milk from its mother, as formerly, but care must be taken to prevent its drinking too much at any given time.

Constipation.—This trouble is more apt to affect young kids, especially new-born kids which may not have been able to drink enough of the first thick milk from their mother's udder. This thick milk is necessary for the purpose of cleaning out their digestive systems, and usually kids do get enough of it and everything goes along normally. If a very weak kid does not have good movements of its digestive system, then a dose of warm castor oil, one small spoonful, will probably be all that is required. If one has not been sufficient, after 3 or 4 hours' time try another, keeping the kid dry and warm and also trying to get it to suck its mother. Usually this trouble can be removed.

Adult goats do not have this trouble as a rule, but in case they require treatment for it, Epsom Salts, 2 or 3 large spoonsful, according to the size and age of the goat, properly mixed in about one-half seer of clean warm water and carefully fed by means of a long-necked bottle, will doubtless remove the cause. Coarse grass, and green leaves to eat, plenty of clean fresh water to drink, and exercise will help to keep one's goats in good condition.

Sore Teats.—These may be caused by scratches or wounds which happen while the goat has been grazing or through some accident, such as a cut. Cleanliness is the most important thing in treatment, the sores or cuts to be washed out with phenyle water (warmed) or else just clean fresh warm water, and iodine applied to the sore places. Following that an application of clean warm sweet oil, or even castor oil, to the affected place will be beneficial. It will be well to keep the udder protected by means of a cloth bag which must be kept clean, and of course the milk must be drawn off regularly. One's hands must be thoroughly cleaned when treating such sores or cuts. It will not do to regard this matter lightly, for one may suffer much loss through carelessness even in the case of sore teats, or wounds, etc.

Special Notes

1. Goats in a weak or undernourished condition may be given a tonic which can be prepared in chemists' shops in larger centres, its ingredients being as follows:—2 ounces of Nux Vomica, 2 ounces of Gentian, and one once each of Ginger and Bi-carbonate of Sodium. All this mixed together in powdered form is to be fed morning and evening, one small spoonful each time to an adult goat, and about half that amount, or even less, to younger animals, according to their age and size. This is a good tonic and will help much in bringing weak goats into good condition. It should be continued as long as seems to be necessary.

2. One should pay attention to the growth of the hoofs of one's animals, especially if they do not have much opportunity to go out to graze or play, etc. The growth of the horny substance on the hoof often causes much discomfort, and it should be removed by means of a sharp knife or sharp blade of a sickle, cutting both sides evenly and not too close to the tender fleshy part near the upper portion of the hoof. At such times it will be well to clean out the feet thoroughly, removing all dirt from in between the hoofs.

If there is any indication of lameness or soreness, it will be well to dissolve one-half pound of copper sulphate in two and one-half quarts (seers) of water, keeping this solution in some earthen vessel. Every day the foot or feet should be allowed to stand in this warmed solution for a few minutes until the trouble is over. Be sure to keep the horny substance evenly trimmed.

3. A large stiff brush, or failing that, a dry rough gourd such as "dodaka," should be kept on hand for the purpose of rubbing or brushing each animal, small and large, not less than 2

or 3 times a week. This will help to keep the skin and hair in good condition and one will also be able to discover any evidences of ticks or lice. If lice are found a good salve to kill them can be made by mixing sweet oil, turmeric powder and a small quantity of fine salt. This should be applied in the places where the lice are found. It will be effective for ticks too, but in either case the quarters where the goats are kept must be thoroughly cleaned out with phenyle water, and for ticks it would be well to burn out the place with either a blast lamp (stove) or wad of cloth soaked in kerosene. Keep a couple of buckets of water ready in case of fire.

4. When the weather is hot it will do no harm to give the goats a nice bath in the middle of the day, say once in two weeks or so. At such times they should be tied in some dry shady place and the excess water should be wiped off their skins so that they may dry off soon. Use soap or soap-sud for making a good lather, and take pains to clean off all of the dirt that may have accumulated on the skin of the animal. If it has been necessary to use the salve mentioned above for the treatment of lice or ticks, a good clean bath will help to get rid of these creatures too, say a day or two after the application of the salve.

5. When milking one should always make it a point to draw off all of the milk, not leaving any unless for the sucking kids to draw off. If one teat or two are left for the kids, one must make certain that they suck out all that is to be had. The leaving of any milk in the udder not only tends to 'dry up' the goat much sooner than is necessary, but also may tend to bring on Caked Udder and other trouble. Hence, both for the sake of a full supply of milk and for the prevention of any udder troubles this point must be observed most carefully. Also, wetting the teat with milk or even water for the sake of making it easier to draw off the milk is not a good thing. It is far better to keep the udder and teats dry and clean when milking. So don't forget that the udder must be properly looked after always, for so very much depends on keeping it in good condition.

6. Learn to be affectionate and thoughtful with your goats, and they will show that they appreciate such treatment. They are intelligent animals and soon learn to know just what is expected of them. Good care is of far more importance than everything else, and this applies to everything connected with keeping them. If you follow faithfully the directions given in this little book you will be surprised how soon you can bring about much improvement in your goats. If you keep them properly, they will do much towards helping to keep you.

RURAL HOME SECTION

Mrs. Sam Higginbottom.

The Editor of the Farmer has been gracious enough to ask me to undertake a page for women. I know I should not do it because I am so limited in time and ability. But if my readers will be good enough to send in questions, requests for recipes and suggestions or subjects about which they would have me write, I will try my best. Working together we may make the page helpful.

Because most of us these days are interested in village uplift, so I am sending herewith the report of my daughter Elizabeth's village work covering the last year. She began the work in November 1933 but did not accomplish much in the first 5 months. It took all of that time and some of this year to get the girls to come. Often our old boys and students tell me of their efforts to help their village. Almost invariably they say, "But I can't reach the village woman. She pulls back." I think some may get ideas from my daughter's report. For many years I have dreamed of our women's department here. We must train women who can help the village home Little can be accomplished by men alone as men get discouraged trying for better living when their wives do not care and will not co-operate. We are blessed here with the wives of our staff—all of whom could help Indian girls and women who come here for study. We can make a beginning next year with wives of rural teachers who are coming for teachers' training. If we can get enough women to come for a short course in gardening, home economics and social service next August we will have such a course. Please let me hear of any who might come.

Herewith is a recipe which can be used in any Indian homes. In America we call these "whole wheat biscuits." In Great Britian they are called scones and so generally called scones in India. Bicarbonate of soda is the only ingredient which will have to be bought. One fourth pound can be secured in any chemists for about an anna and would be enough for several times.

Recipe for soda Biscuits :

½ teaspoonful of finely ground salt
3 teaspoonful of sugar
1 level teaspoonful of bicarbonate of soda, and
2 cups full of *atta* into a sifter and sift into

a *degchie*. Do not throw away the *chokar*; put it also into the *degchie*. Fill a cup a quarter full of ghee and fill the cup up with dhai. Mix with the other sifted ingredients in the *degchie*. Knead gently. Spread some *atta* on the board used for rolling *chapaties*

(Continued on page 149).

REPORT OF RURAL RECONSTRUCTION WORK, CARRIED ON BY ELIZABETH HIGGINBOTTOM

This work started with the idea of being a survey among the women of the villages. With that in view, we started a small school with women teachers; we collected a few medicines and that was all we had. The teachers were from the home for untainted children of lepers, and had read up to the eighth class, that is one of them had, the other was fourth class with Dr. Forman's course in laboratory technique, and still another was a girl who could never learn to read or follow any sort of intellectual pursuit.

We began walking through three of the villages surrounding our small property, begging the families to send their daughters to school. I did this day after day, picking out individual girls to plead for, as well as making a general appeal to the *mukhias* and the *zamindars*. A few boys began to straggle in and girls would come to the gates, but run when they saw me coming to welcome them. The parents would give, first one excuse and then another for the girls. One parent would say "she is afraid that you will beat her." Another; "but she is married," and still another was the excuse that a Mussulam had come to say that we would feed them with bread or that we were hypnotists who would steal the children and take them off to where the Government was building bridges.

After about two or three months of this discouraging work I gave up all idea of a survey and thought that since the need was so tremendous I would just go slowly and eventually bring some of the conveniences of civilization to the villages. We let the boys come to the school and we took the child of a *coolie* woman who was working on the place, as a sample. He had been fed some drug for several days and his tummy was in a bad way. We bathed him amid the tears of the mother, at first, and later on when she saw how comfortably he slept in the shade of a mangoe tree after he had been bathed and fed, she would even go so far as to heat the water for his bath. We lost that baby during the summer when I was in the hills but a beginning was made.

The next thing we did was to buy some combs and give shampoes and delicing. While all this was going on there were stories and songs and other such forms of amusement. From the first brave girl to subject herself to our treatment in that, we now have about twenty girls who come two or three times a week and not only comb their hair with our combs but wash their clothes with our soap, drink our *sujee* and milk and spend an hour in reading and put in what remains of the morning learning, to knit.

We have quite a thriving dispensary, and the boys' school, now under a master has about thirty boys. The boys each have a small garden which they tend with great care outside of school

hours. We have also persuaded a good many of the boys to start gardens in their courtyards. We give the seeds and go around every now and then to see how they are getting on. Of course they are only about one little *lowkey* and a cock's-comb after the chickens and squirrels and all the other pests have had their share, but even so it is a beginning and we are hoping for more results in our second year. Mrs. Pugh has come to help during the last few weeks and others are promising to come.

I feel that the important thing to do for the villager is to develope his imagination. The trouble is that he does not think himself as ever being anything but what he is now, poor and dirty and infinitely tired, fever in the spring and fall, crop failures and debt. The adult villager in 99 cases is beyond help, but when I show the children around the Agricultural Institute, I say, "Now when you boys come here to study I want you to do so and so." It is becoming a dream and sometime in the twenty or thirty years, I am sure that some boy who is the son or the nephew of one of our children will really come here to study agriculture. I have had the privilege of taking boys to the Swadeshi Exhibition and Farmers Fair. It is a rare treat to watch the wonder on their faces, to really see the light of a new day, dawning there.

(Continued from page 135)

right step. But it must not lose sight of its other recommendations such as :—

1. Improvement of transport facilities including rural communications.
2. Lowering of railway freight rates and grant of other railway facilities.
3. Regulation of regulated markets.
4. Standardization of weights and measures.
5. Fixation of standards and grades of commodities.

(Continued from page 147)

and half of the mixture on to the board. Pat it gently with a little atta sprinkled on top until about 1½ inches high. With a small, tin, not more than 3 inches in diameter, having a sharp edge, cut circles out of the dough on the board and lay on the *tawa* or hot plate which should be somewhat heated over a slow fire. Continue to put the rest of the dough on the board, pat and cut laying all the biscuits on the *tawa*, cover with another *tawa* and on top of that dut burning coals. In from 10 to 20 minutes the biscuits should be baked through to a pretty brown on both sides. A small *tajal* would be better but it is not always available in an Indian home.

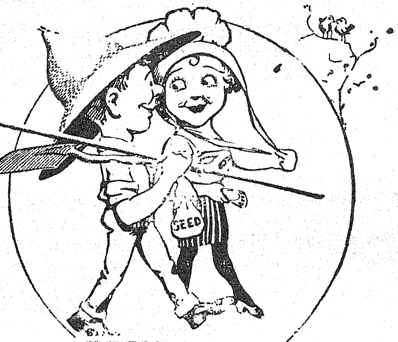
METEOROLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE

February, 1935

Date.	Max. Temp	Min. Temp	Mean Temp	Percentage of Humidity.	Atmospheric Pressure	Rain for the day.	Rain since Jan.	Wind direction.	Remarks.
1	74	63	68·5	84	29 82	0·06	0·82	W.S.W.	Land levelling and ploughing of fallow lands continued.
2	71	60	65·5	82	29·84	Nil.	,,	,,	
3	71	58	64·5	75	29 84	,,	,,	E S.E.	Digging of early potatoes continued.
4	65	53	59·0	85	29 81	0·65	1·47	W.S.W	
5	70	53	61·5	82	29·75	Nil.	,,	,,	Cultivating hill potatoes.
6	71	55	63·0	80	29·74	,,	,,	W.	Roguing standing wheat crop.
7	73	54	63·5	80	29 70	,,	,,	S.S.W.	
8	75	57	66·0	78	29·68	,,	,,	W.	Watching standing wheat and gram crops against birds.
9	78	54	66·0	76	29·66	,,	,,	,,	
10	78	51	65·0	75	29·74	,,	,,	S.	
11	77	50	63·5	85	29·76	,,	,,	S.W.	
12	76	50	63·0	76	29·78	,,	,,	S.	
13	80	54	67·0	72	29·76	,,	,,	Calm.	Plucking and sale of other vegetables continued as cabbages, cauliflower, tomato, brinjals, etc.
14	85	57	71·0	66	29·74	,,	,,	N.N.W.	
15	85	60	72·5	69	29·70	,,	,,	E N E.	
16	86	64	75·0	85	29·66	0 01	1·48	N.	
17	77	56	66·5	78	29·69	0·03	1·51	W.N.W.	
18	75	52	63·5	68	29·65	,,	,,	W.S.W.	
19	76	54	65·0	65	29·61	,,	,,	Calm.	
20	78	53	65·5	64	29·68	,,	,,	W.S.W.	
21	80	52	66·0	60	29·67	,,	,,	W.	
22	81	52	66·5	65	29·59	,,	,,	Calm.	Cleaning threshing floor for Rabi harvest.
23	84	55	69·5	48	29·51	,,	,,	E.	
24	84	56	70·0	50	29 53	,,	,,	Calm.	
25	83	54	68·5	45	29·58	,,	,,	Calm.	Harvesting of mustard.
26	84	55	69·5	65	29·64	,	,,	W.	
27	86	60	73·0	70	29·59	,,	,,	E.	
28	88	62	75.0	55	29·62	,,	,,	W.N.W	Harvesting of gram started.

March, 1935

Date	Maximum Temperature.	Minimum Temp.	Mean Temp.	Percentage of Humidity.	Atmospheric Pressure	Rain for the day.	Rain since Jan.	Wind direction.	Remarks.
1	88	51	69·5	48	29·66	Nil	1·51	W.	Land levelling continued.
2	82	54	68·0	45	29·66	,,	,,	Calm	
3	82	57	69·5	44	29·66	,,	,,	Calm.	
4	85	57	72·0	45	29·56	,,	,,	,,	Harvesting of early potatoes over.
5	85	57	70·5	48	29·70	,,	,,	West	
6	84	55	19·5	40	29·69	,,	,,	,,	Ploughing of kharif fallows.
7	83	54	68·5	40	29·75	,,	,,	E.	Digging of hill potatoes started.
8	84	56	70·0	46	29·68	,,	,,	W.	
9	84	53	68·5	44	29·78	,,	,,	W.	Harvesting gram almost over.
10	84	56	70·0	38	29·72	,,	,,	N.	Harvesting of berra started.
11	87	56	71·2	36	29·73	,,	,,	W.	
12	90	60	75 0	34	29·74	,,	,,	W.	Harvesting of mustard continued.
13	93	62	77·5	38	29·67	,,	,,	W.	
14	95	61	78·0	38	29 63	,,	,,	W.	Harvesting of wheat started.
15	95	63	79·0	52	29·64	,,	,,	E.	
16	96	66	81·0	55	29·64	,,	,,	E.	Sowing bajra for summer fodder.
17	97	67	82·0	37	29·66	,,	,,	W.	
18	96	68	82·0	34	29·65	,,	,,	W.	
19	95	64	79·5	26	29·58	,,	,,	W.S.W.	Sale of vegetables continued.
20	94	65	79·5	19	29·55	,,	,,	,,	
21	97	68	82·5	22	29·52	,,	,,	W.	Harvesting wheat by reaper.
22	97	67	82·0	43	29·62	,,	,,	W	
23	95	64	79·5	40	29 58	,,	,,	W.	Threshing gram by thresher started.
24	96	67	81 5	42	29·52	,,	,,	W.	
25	97	77	87·0	32	29·50	Trace.	,,	W.	There were a few drops of rain the previous night.
26	100	72	86·0	45	29·56	Nil	,,	W.	Threshing mustard by bullocks.
27	98	74	86·0	48	29 51	,,	,,	W.	
28	100	74	87·0	41	29 52	Trace.	,,	W.S.W	
29	97	71	84 0	34	29·56	Nil.	,,	W.N.W.	
30	93	70	81·5	48	29 56	,,	,,	,,	
31	92	70	81·0	40	29·55	,,	,,	,,	



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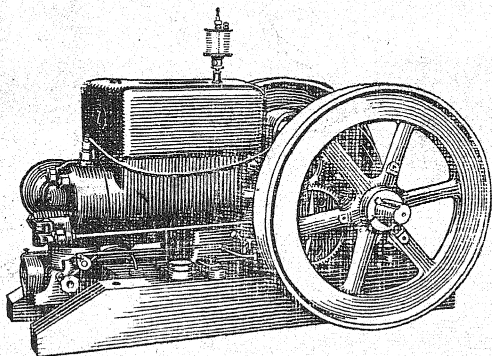

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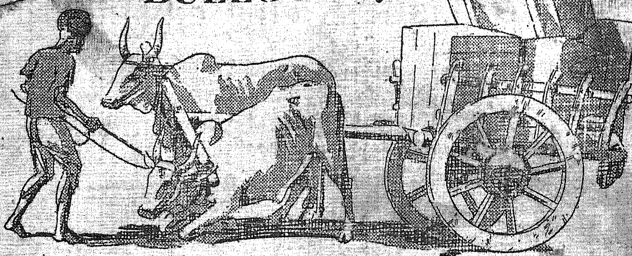

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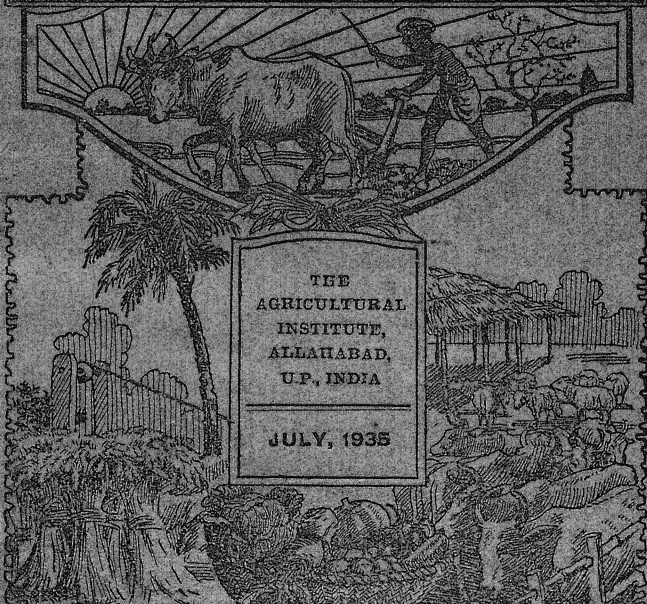


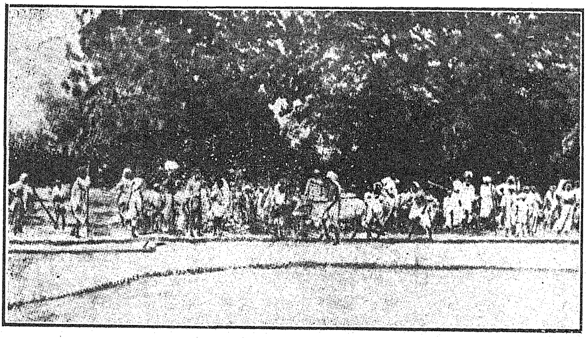
THE
AGRICULTURAL
INSTITUTE,
ALLAHABAD,
U.P., INDIA

JULY, 1935

"In order to get the best results in farming the best use must be made of the dearest or scarcest factor of production."

E. SEWELL DAWSON.

THE WAH-WAH PLOUGH IN ACTION



PLOUGHING DEMONSTRATION

SERAI AQIL

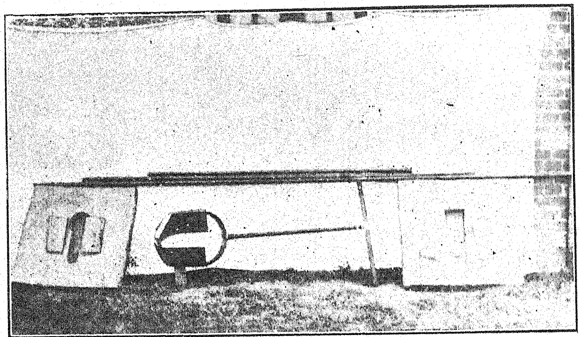
District Allahabad

The Wah-Wah plough continues to win favour and users —"better than medals and prizes; it is being bought in increasing numbers for actual use."

See Vol. VII, No. 3, May, 1933, of *The Allahabad Farmer* for a description of the "Wah-Wah" plough.

See the advertising section of the current number for particulars regarding cost.

The Bore-hole Latrine

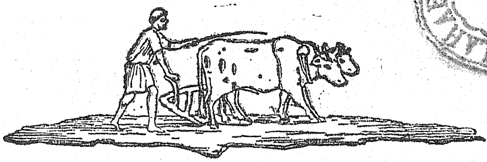


THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

The Allahabad Farmer

A BIMONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE



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RURAL RECONSTRUCTION

The rural population of India, (as of most countries of the world) is greatly in excess of the urban population, but far less attention has been paid to it by the government and other public authorities than to the urban. The reason for this is that the urban population is concentrated, usually uocal and organises itself to secure what it wants, whereas the rural population is scattered, and finds it exceedingly difficult to organise and co-operate. It therefore does not speak with the unanimous voice of city folk. This has been so from the dawn of history. But this does not mean that this condition is either wise or right. History shows from the breakup of the Greek and Roman Empires that the downfall of the Empire was due very largely to the revolt of these neglected rural folk. One of the lessons of history seems to be that the government which would persist and prosper must develope and care for the interests of the rural folk.

Of recent years some consideration has been given to the problems of country people. President Theodore Roosevelt in America brought the attention of the people in the United States to the rural folk and their needs. He appointed the Rural Life Commission whose investigations have proved of great value. Sir Horace Plunkett in Ireland and many other workers in continental Europe worked successfully to better the life of village folk.

A study of rural conditions shows that seldom in any country in the world is one village able to support the services which it needs for a proper and normal civilised life. Various expedients have been tried to bring to the scattered villages the amenities of civilisation:—The travelling library; the consolidated school where instead of having a small inefficient one teacher school in each of several scattered villages; at some central village, a central school has been put in with the pupils graded into classes and a number of teachers. This consolidated school has proved itself one of the most satisfying and important means of improving education in rural communities. Better teaching has been provided, with more highly qualified teachers. The course of study for village children has been lengthened, and the curriculum broadened so as to in-

clude not only the literary subjects, but science and art and music. While much has been accomplished yet much remains to be done to adapt the curriculum to the needs of the consolidated village school. A few years ago a noted American educator, Dr. Kenyon Butterfield, who had been president of two important American state agricultural colleges was sent round the world to study the rural educational problem. At the conclusion of his study of conditions in India, he spoke of a "Rural Reconstruction unit" by which he meant from ten to fifteen continuous villages, having a sufficient population to support the various activities which the village folk need, yet sufficiently compact and near together for both the children and the adults to come to the centre. He said the services the village needed were for public health, maternity, preventive medicine, sanitation, agriculture and subsidiary and related occupations and industries, education, recreation and re-creation. This involves domestic science for the improvement of the village home, adult education for those who need it, (in most parts of India an overwhelming majority of the population;) education for the boys and the girls. This demands the adaptation of the curriculum and courses of study to meet the needs of village folk; the provision of medical service as well as public health and sanitation. Under re-creation would come art, music, religion, anything which would strengthen the spiritual nature. Under recreation would come organised games of all sorts to suit all grades and ages of the population. This would develope a wise use of the leisure of village folk.

Fortunately, the Government of India and the provincial governments have set aside funds (totally inadequate) for rural development with special officers to develop the rural programme. This is one of the most encouraging incidents in modern India. The success of this rural reconstruction work of the government and all other public bodies and individuals who co-operate with the gevernment will depend very largely on the training and spirit of those teachers and demonstrators who actually come in contact with village folk. As far as I know the various schools, colleges and institutions of India have not provided specific and definite courses and instructions for rural workers for the villages. Unless this training is provided a great deal of the money so generously given will fail to secure its fullest beneficial returns. Training for village workers needs more than a short course. A two years course with practice would suit, depending on the qualification of the pupil. Perhaps the most urgent need for the success of rural reconstruction is the provision of suitable training centres for workers. I would stress beyond all else the training of women, who should be able to go into the Indian village and improve the village home. Of all the tasks before India today

this at once is the most difficult, the most complex, and the most necessary. Here is where the missions may be able to contribute to the well being of India. Both the government and the people of India have for over a century welcomed mission co-operation in education and medical work. One feels sure there will be a continuation of this co-operation, if missions will set themselves out to give of their best to the improvement of the Indian home. The village home does determine and will determine the civilisation of India. No civilisation can rise higher than its homes. If the home is enlightened and progressive and the women folk educated, the civilisation will correspond but if the home is filled with darkened minds who live by their fears and superstitions, the civilisation will follow. Hence the need for the fullest co-operation between government in its various departments, other public and private bodies, as well as all individuals of goodwill, to improve the village home which will in turn cause improvement in every other form of proper village enterprise.

THE ASCENT OF SAP IN PLANTS

To explain the rise of water to the top of plants, some of which attain to a height of a hundred feet or more, has been a very great problem for plant physiologists. Plants give out water from the surface of the leaves at all times, so that there is a regular stream of water flowing upwards in plants. This flowing uphill has appeared to many as a paradox. Three University of Chicago scientists, Homan, Young and Shull have found that desert plants pull up the water, and the column of water in them can withstand, without breaking a pull measurable in many tons per square inch. This pull which these scientists called stromogenic tension is in the neighbourhood of 22·5 tons per square inch which is equal to about 562·5 maunds per square inch. This tension therefore not only accounts for the ability of the slender wires of water in the tubes of trees to pull themselves to the tops of the tallest trees now living, but leaves a margin of strength sufficient to lift water to nearly ten times their height."

Abstracted from the Science News Letter.
January 26, 1935.

"Centuries before modern knowledge of food values in citrus fruits, a Chinese writer declared that the peel of the orange was a good tonic". *Science News Letter.*

MILK GOATS

Indian Breeds and Varieties—I

By A. E. Slater Esqr., B.S.A., & S. Sardar Singh Bhatia, I.D.D. (Hons.)

Goats have been kept in India for very many years, in large numbers but nevertheless very little, if any, scientific work has been done in regard to them. There is here a virgin field of the greatest importance, for Europe, England and America, have long realized the value of the goat, giving to it the term the "poor man's cow". An adequate milk supply is of the greatest importance to the villager, who is often too poor to keep a buffalo or cow, and who is even unable to purchase milk.

We would point out that whereas both the Government of India, Imperial Council, and Provincial Governments have spent time and very large sums, on the improvement of all other kinds of live stock, not forgetting poultry, that almost nothing has yet been done to improve the "Poor man's cow". The goat provides on a small quantity of feed, a nutritious and plentiful supply of milk for the cottager and humble peasant. It has clearly been demonstrated in Europe that from 5 to 7 goats can be kept as cheaply as one cow.

A word in regard to the value of goat's milk. The T. B. Bacillus has not yet been found in goat's milk. This fact is one of great importance, more so as this dread disease is on the increase in India. Further the digestibility of goat's milk is much greater than that of cow's milk or buffalo's milk. Its value for dyspetics is shown by the fact that in New York, Chicago, and other large cities in the U.S.A goats milk retails for twice the price of the best cow's milk, being in much demand for hospitals and sanatoriums.

Coming now to a comparison of goat's milk with cow's milk, certain interesting facts stand out at once. Indians do not, we believe, like goat's milk. Why? Perhaps, because of its odour and taste. This is entirely a matter of management. We have produced goat's milk absolutely without odour and when offered to friends to drink, could not be distinguished from cow's milk. The peculiar taste often associated with goat's milk, is probably due to the goats having been fed on Nim leaves, which are extremely bitter, and also to the presence of the male with the milking herd. In many ways goat's milk is certainly superior to cow's milk. An important difference between cow's milk and goat's milk is this. Goats milk is Alkaline, cow's milk Acid in re-action; a difference which may mean life and death to any one with a very weak stomach. Further cow's milk requires two hours for digestion,

goat's milk 30 minutes; a saving of $\frac{3}{4}$ of the work for the stomach; another life and death difference in many cases of weak digestive organs. If one studies, the mineral-salt contents of three milks, *i. e.*, cow, goat and human, it is interesting to note that there are twelve different mineral-salts found in the three kinds of milk, but not all of them in any one milk. All but three of the twelve are to be found in goat's milk, only six in cow's milk, and but five in human milk; a difference of no mean importance. Further cow's milk is almost without iron, whereas goat's milk has from 7 to 10 times as much of that very important element, in the blood of all warm-blooded creatures. High medical authorities have said that "If cow's milk contained a little more iron it would be the 100 per cent perfect food." It is also well known that the phosphates are bone forming elements; of 7 phosphate salts the milk of the cow carries 0·508 parts, the milk of the goat which is a much smaller animal, 0·319; and human milk the disproportionately small total of 0·096. When we come to the salts containing potassium, we find the order reversed, and the small goat showing 0·483 parts to the cow 0·282; a truly remarkable thing, when we consult Webster and find him telling us that "Potassium has the most powerful affinity for Oxygen of any known substance, and takes it from every other compound." Add to this the iron content in goat's milk, and we have an Oxygen-absorbing power in goat's milk uncomparable with any other milk.

Thus has Chemistry clearly shown us, why the "poor man's cow", is so strong and vigorous, and so readily adaptable to all climates, and why her milk is so super-superior as a food, and also a therapeutic agent, both of which are being continually demonstrated in many thousands of cases all over the world.

It is these factors that make goat's milk an ideal feed for infants and children. In India this is of the utmost importance.

Breeds.

Dealing principally with the United Provinces and the Punjab there are two distinct breeds, the Jumna Pari and the Bar-Bari. A variety known in the Punjab as the Betal seems to be a Jumna Pari with some admixture of other blood.

In the Bombay Presidency a valuable breed the Surti is also to be found. In Kashmir and hilly tracts we have the long haired hill goats called Kashmiri goats. In the Deccan there is a breed known as the Osmanabad. Alwar State has a variety which also clearly resembles the Jumna Pari, being a little smaller and not so high on the leg.

Jumna Pari Goats.

These dual purpose goats are to be found in many places in the United Provinces, the principal being Etawah district. They are also found in Gwalior State and Benares.

Characteristics.—The Jumna Paris are a large dual purpose goat, combining meat and milk qualities. They seem to be of Nubian and Egyptian origin, and closely resemble the Nubian goats as bred in England and the United States of America. Their charactaristics are as follows:—

H. S. Holmes Pegler in his, "The Book of the Goat," states. "The best Indian goats are chiefly the lop-eared type, known as the Jumna Pari. They closely resemble the Nubian, having, like these long, wide pendulous ears, a bow-shaped face, and being tall and leggy. They are said by residents to be splendid milkers, carrying immense udders with big teats. Specimens were at one time brought into this country, having been used on Board P. & O. Steamers to supply milk to the passengers."

To this description, we would add that these goats are not bred to any standard colour or markings ; they have a most pronounced Roman nose. Carry a large amount of long and thick hair on the buttocks. The horns are short and flat. The average length of adult males from nose to root of tail is 53″ ; height from hoof to withers is 37″ ; weight 150 lbs. Female length 46″ ; height 34″ ; weight 106 lbs.

They are ideal for village conditions, being hardy and active ; In this respect they are superior to Bar-Baris, which are more suited to town conditions.

Performance.—The average milk yield during lactation is 465-0 lbs., and the average lactation is of 274 days. The average milk yield per day during the lactation is 1.8 lbs. The average maximum yield a day is 3.4 lbs. The highest milk yield during a day for one of our Jumna Pari goats (No. 45) is 8.4 lbs.

Being supposed to be of Nubian origin, the butter fat content of the milk is very high. Some of the goats test as much as 7.8 per cent. But the average percentage butter fat is 5.3. The dry period on the average is about 108 days. In practice they usually kid only once a year. These goats give birth to one, or sometimes two kids. The average weight of kids at birth for males is 8.4 lbs. and females 7.7 lbs. The gestation period on the average is 150 days. Generally they are bred during July, August, September, and October ; and kid during November, December, January, and February.

BAR-BARI GOATS.

These goats are found most commonly in the Etawah district. They aro also found in Agra district, and Gwalior State.

Characteristics.—The Bar-Bari is of a dairy type. Their small size renders them unsuitable for meat production. They can be compared with the Jersey cow. Their origin seems to be Africa, H. S. Holmes Pegler in his book referred to above calls what clearly appear to be Bar-Baris. "The dwarf goat of Guinea."

The Encyclopaedia Brittanica defines Bar-Baris as "The dwarf goat or Guinea goat, of Central and West Africa, resembles a small English goat in appearance. These goats are also found on the Nile and in Mauritius, Madagascar, and Bourbon.

Our experience would seem to show that these goats give a large amount of milk for their size. They carry large well shaped udders. Are short haired, and have small upright ears, and the facial line is straight. They are very short in the leg which is of fine bone. They have the typical dairy wedge shape.

They are not likely to be so valuable for open grazing conditions, though a valuable goat for more confined conditions." The average length of the adult male is 40″; Height 27″; weight 80lbs,; of the adult female length 36″; height 23″; weight 75lbs.

Performance.—The average milk yield during lactation is 307lbs., and the average lactation is of 227 days. The average milk yield per day during the lactation is 1·4lbs., and the average maximum yield a day is 3·3lbs. Maximum milk yield a day for one of our Bar-Bari goats (No. 52) is 6·0lbs. The average percent of butter fat is 3·8.

The goats, if desired, can be bred twice a year. They are very prolific. Generally they give birth to twins and triplets. The average weight of kids at birth is 4·0lbs. The gestation period is on the average 146 days, about 4 days, less than Jumna Pari goats.
These goats can be bred at any time of the year.

(To be Continued).

More than 18,000 barberry bushes have been destroyed in the U.S.A. in 15 years of Government campaigning to proteot wheat against stem rust. *Science News Letter.*

A U.S.A. Government scientist has discovered that grapes may be made shatter-proof—so that they do not drop from the stem in shipping—by the application of carbon dioxide gas. *Science News Letter.*

HERBICIDES OR CHEMICAL WEED KILLERS

S. C. Chowdhury

Chemicals have been used extensively and are also used today in some countries for the killing of weeds. And it has been reported that in various cases chemicals intelligently used have been found more expeditious and economical in the distruction of weeds than any other means for weed-killing.

A large number of poisons are known today to the modern chemist for destroying plant growth. But there are a number of practical difficulties which arise as to their use as herbecides.

The first difficulty arises from the fact that when a herbicide is sprayed, it kills only the upper shoots of the plants and fails to kill the roots that are buried in the soil. The shoots and the leaves dry up, but soon the plant rises up again from the living root in the soil.

The second difficulty arises from the fact that it is difficult in most cases to use the herbicide to kill the obnoxious plants without working permanent injury to the soil or to the neighbouring cultivated plants. These considerations have limited the chief usefulness of chemicals as herbicides in the following cases.

(1) When an especially obnoxious weed occurs in a limited locality and is to be destroyed regardless of the consequences to the soil or to the neighbouring plants.

(2) When the weed plants are much more sensitive and much easily acted upon by the herbicide than the associated useful plants.

(3) When the weeds occur on roadsides and paths where the making of the soil permanently sterile does not matter much.

The Type of Toxic Action.

The chemicals now used for the killing of noxious weeds may be classsified on the basis of their type of toxic action as follows.

(1) First substances which by their osmotic action plasmolyze cells and prevent plants so treated from obtaining water. An example of such a substance is common salt.

To use the osmotic action of chemicals for killing plants requires that the concentration of the solution shall be rather high at least higher than the osmotic concentration of the cells of the plant.

(2) A second class includes those chemicals which by their

physical action dissolve or dilute protoplasmic constituents and disorganise the cell by changing its permeability and other physical properties, substances belonging to this class are the hydrocarbons.

(3) A third type includes chemicals commonly called "protoplasmic poisons which kill enzymes, coagulate proteins or combine with other constituents of the protoplasm and bring about a cessation of the life-processes in the cells. Examples of chemicals belonging to this group are Mercuric chloride, cyanides, copper salts, Iron salts, etc.

(4) A fourth type includes gaseous poisons like sulphur dioxide. These react with the respiratory pigments of plants and interfere with the oxidation—reduction balance in cells. The "respiratory chromogens" are either completely oxidised or decreased in number. The cells fail to take in oxygen and consequently life-processes come to a stand still.

Common Herbicides.

Carbolic Acid.—As a general spray this is expensive and not very effective. Plants may be temporarily injured by heavy spraying with carbolic acid, but the fluid does not penetrate well and the treated plants usually recover. Pammel tried a 25 per cent. emulsion of carbolic acid in water to destroy cnicus arvensis. When used as a spray it is of little use, but when applied at the base of the plants the creeping underground stems may be killed to some distances—8 or 10 inches—though they are apt to sprout again from below the injured parts. Voelcker tried a 5 per cent solution of carbolic acid against Allium vineale which reduced the weed without effectively destroying it. Altogether carbolic acid does not seem to be very promising as a weed killer.

Nitric Acid.—Nitric acid as a weed killer is used to a very limited extent. Uptil now only about a hundred experiments have been done with it in Norway among spring cereals. It has been found to destroy 73 per cent of the weeds present and to make an increase in the yield of crops. In some cases a manurial effect of nitric acid came to notice.

Sulphuric Acid.—To kill weeds, extensive use of sulphuric acid is being made in France. Rabate says that a 8 to 10 per cent solution quickly scorches Ranunculus arvensis, sinapsis arvensis, Raqhanus raphansistrum, Polygonum aviculare and spp. of Matricaria and a 12 to 14 per cent solution kills Papaver spp. scandix pectenveneris and Agrostemma githago. A 10 per cent solution of sulphuric acid has been found to kill Raphanus raphansitrum, sonchus arvensis and cirsium arvense without doing any injury to flax. Gelpke found that a 3½ per cent solution of sulphuric acid when

sprayed in a wheat and oat field slightly injured oats and wheat but killed Sinapsis arvensis, Stellaria media, Papaver spp., Capsella bursa-pastoris and Anthemis Cotula. Gordon showed that spraying with a 5 per cent solution of sulphuric acid was successful in destroying Pteris aquilina. Experiments of Skilbeck and Coles indicate a 5 to 7 per cent solution of the acid is required for the destruction of Sinapsis arvensis. Raphanus raphanistrum, Stellaria media, Senecio vulgaris and veronica spp., 10 to 12 per cent solution for Papaver spp. and 10 per cent solution for Ranunculus arvensis. MacDowell report 100 per cent destruction of Sinapsis arvensis by the spraying of a 7 to 7½ per cent solution of sulphuric acid. Aslander lists upwards of 50 species of weeds reported by different authorities to be destroyed by sulphuric acid solutions of various strengths, varying from 3·5 to 10 per cent.

Hydrochloric Acid.—Experiments to utilise hydrochloric acid as a herbicide have been carried out in France. The results obtained have been uncertain and unsatisfactory. Heavy applications of weak solutions of hydrochloric acid, however will kill weeds but the effects of such treatments are said to persist—The soil becomes sick and hinder vegetation from reasserting.

Copper Sulphate.—Amongst chemical weed-killers copper sulphate is one of the most efficient. Bonnet a vine-grower found it out fortuitously. He observed that the mustard which grew amongst the vines was destroyed by copper sulphate while oats growing in the same condition were immune. Trials made by Benard and Brandin showed that a 5 to 10 per cent solution of copper sulphate disorganised the cruciferæ growing amongst cereals without injuring the latter. Its disorganising action is more powerful than that of Iron Sulphate whilst it requires 15—20 per cent. of this latter salt 4—5 per cent. of Copper Sulphate suffices to produce the same effect at the rate of 44—88 gallons per acre.

Spraying with Copper Sulphate has been found exceedingly useful in destroying weeds. Spergula arvensis and Persicavia may be killed by spraying with 4 and 5 per cent. solutions of Copper Sulphate respectively. While the following weeds are more or less crippled and seeding largely prevented by spraying with a 5 per cent. solution of Copper Sulphate. Papaver Spp., Agrostemma githago, Polygonum convolvulus, Rumex spp., senecio vulgaris Taraxacum officinale, sonchus arvensis centaurea cyanus, lepidium campestre and Tussilago farfara. Against Cninus arvensis better results are obtained by dressing an acre with 16 lb. of Copper Sulphate dissolved in 60 gallons of water. Wright recommends two succesive sprayings for Sinapsis arvensis with a 3 per cent, solution of Copper Sulphate for its eradication than a single spraying with double strength solution.

Iron Sulphate.—All plants being more or less sensitive to the action of iron sulphate, it is evident that by using a determinate quantity of this salt all the plants which have a less resistance can be eliminated from a given crop. Thus grain crops possess a surprising resistance to this chemical and it is possible to destroy all the weeds in a field of grain-crop without injuring the crop. Steglich has treated different adult plants with a 20 per cent solution of iron sulphate and obtained the following results. Grain crops are not injured, peas, trefoil, linseed, charlock suffer from this treatment, potatoes, beets, haricots, lupins are greatly damaged, mustard is killed. Stender confirms Steglich's results. He treated cultivated plants with a 15 per cent. soultion of iron-sulphate—spraying at the rate of 35.2 gallons per acre and found no damage done to cereals, blue lupin, red trefoil, colza, poppy and carrot, but moderate damage on peas, flax and serradelle, finally much damage on millet, rape white mustard potatoes and beet. Twenty five per cent. solution of iron sulphate destroyed almost all weeds—Equisetum spp. Urstica urens, U. dioica, and carex resisting perfectly.

The action of iron sulphate solutions is especially deadly to young plants when they have only three to four leaves, if the adult plants resist 15—20 per cent. solutions young plants can not stand much smaller doses. Strong solutions of iron sulphate are not, therefore, necessary when used rationally, and as Dumont found, a 5 per cent. solution suffices in most cases especially when it is a case of destroying young mustard. The older the plant to be destroyed the stronger should be the solution, thus mustard in flower requires a 10 per cent. solution, adult mustard a 15 per cent solution. Gwalling recommends for the destruction of mustard a 7—10 per cent. solution. Linet agrees. To destroy sinapis arpensis Hitier estimates that 88 gallons of a 10 per cent solution per acre suffice. Weiss also recommends the same quantity but of 10—15 per cent. strength. Schultz concludes after numerous tests that it is necessary to use 15 per cent. solutions although young weeds suffer from a 2—3 per cent. solution. It is necessary to spray when the plants have only three or four leaves, it is true that cereals suffer slightly when young even when only a 7 per cent. solution is used but they soon revive and grow afterwards with increased vigour. To destroy young sinapis and mustard 5—10 per cent solutions suffice, but to destroy weeds of all kinds a 15 per cent solution should be used.

Maier—Bode states that the common garden Poppy is very sensitive to a 13 to 20 per cent. solution of iron-sulphate, but a 15 per cent. solution does no permanent harm to the cereal crop.

Lime.—Lime is recognised as almost a specific reducer of certain weeds that only flourish on acid soils or soils containing very

little lime in the top few inches. Pteris aquilina, Spergula arvensis, Chrysanthemum segetum, Rumex acetosella, Chrysanthemum leucanthemum, Centaurea cyanus, Ulex europoeus, Cytisus, Scoparius, calluna sp. Erica sp are almost plentiful on soils deficient in lime, and will be gradually got rid of by the application of lime.

Mercuric Chloride.—Mercuric Chloride acts on plants like copper and iron sulphates, but proportionately with greater intensity. If the plant is placed through the roots in contact with a certain dose of corrosive sublimate, it dies. Monillefert found that this dose for vines planted in 3 litre pots was 2 grammes in 250 cc. of water, the dose of 0.5 gms. in 250 cc. of water had no effect on the vine but killed weeds, chiefly Mercurialis annua, senecio wilgaris, sonchus oleratus, Borrago officinalis, sinapis arvensis, Malva sylvestris and Amarantus blitum.

Sodium Arsenite.—Sodium Arsenite has been found to be a first class weed-killer by many investigators. Experiments by Gray show that a heavy dressing of sodium arsenite kills 85 to 90 per cent of convolvulus arvensis but does not eliminate it altogether, moreover all other vegetation perish and the land remain barren for at least 14 months afterwards. Crafts claims that if the solutions of sodium arsenite are acidified with sulphuric acid the weed-killing is more complete and not permanent injury is done to the soil.

About ⅙ per cent. solutions of sodium arsenite has been found effective against Pteris aquilina and cirsium arvense by Adams. Rabate in France used 2½ and 5 per cent solutions for the destruction of Raphanus raphanistrum but the oats were seriously damaged and the output much reduced. According to Bruce and Madden most of the weeds and the clovers can be killed out by spraying with 1 lb of arsenic pentoxide in about 8 gallons of water, at the rate of 240 gallons per acre. Muenscher made attempts to kill the weed seeds in the soil by top dressing with lead arsenate, from 10 to 1 .0 lb. per 1,000 sq. feet but this did not prevent the germination of weed seeds, not the growth of seedling.

Sodium Chloride.—Salt in excess is injurious to plants, and certain plants stand it with difficulty. Wendler found common salt an excellent means of destroying Sinapis arvensis. Rabati's work indicates that a solution containing 55—66 lbs. of salt to 22 gallons of water is very effective in killing many of the weeds infesting cereals without working any injury either to the crop or to the soil—Raphanus raphanistrum and Sinapis arvensis are completely destroyed. Polygonum aviculare, Convolvulus arvensis. Stellaria media, Ranunculus arvensis are severely scorched. According to Rudolfs top-dressing of salt at the rate of—1 lb. per

sq. foot is very effective against convolvulus arvensis but this treatment renders the soil barren for several seasons afterwards. Hill recommends the application of 1 lb. of salt per 100 sq. ft. on paths for the destruction of road side weeds.

Potassium Chloride:—Potassium Chloride has been found by Steglich to kill Sinapis arvensis, Rumex acetosa Polygonum convolvulus, Equisetum spp; when used as a spray of 15 to 30 per cent. strength. The quantity required per acre depends on the degree of weed infestation—usualy the amount being 300 lbs. per acre. Cereals are not damaged but potatoes, peas, lupin and flax are severely injured. Spraying with potassium chloride has a good after-effect—the land gets rich in potash. The only disadvantage lies in the cost which is considerably high.

Sodium Chlorate:—Trials in New Zealand, where Senecio Jacobaea is a serious weed have indicated that a light spraying with 3 to 5 per cent solution of Sodium Chlorate will kill this weed without serious injury to young grass. A 5 per cent solution has been found effective against Ulex europoeus. In Tasmania a 7½ per cent solution of Sodium Chlorate has proved cent. per cent. effective in destroying Senecio Jacobaea, when used at the rate of 70 per cent. gallons per acre. Ohio Agricultural experiment station recommends a 10 per cent. solution to kill out Agropyrum repens and Cirsium arvense. Idaho Agricultural Experiment Station reports cent. per cent. destruction of convolvulus arvensis by the application of Sodium Chlorate at the rate of 160 lbs. per acre. Bates reports the destruction of stellaria media in a potato crop and stellaria media and Senecio vulgaria on an area of "recently" planted bulbs by spraying with 1 and 2 per cent solutions of Sodium Chlorate using 80 gallons per acre and doing no injury to the crops. Experiments of Clouston and Hill show that the minimum effective dressing of Sodium Chlorate per acre to destroy certain weeds are as follows: Stellaria media 15 lb.; Senecio vulgaris 30. lbs; Ranunculus repens, 50 lb.; Polygonum aviculare 100 lb.; Tussilago farfara and Urtica dioica 150 lb.; Agropyrum repens 150-200 lb.; Cirsium arvense 250-350 lbs. Rumex acetosella and Rumex spp. 400 lb.—.00 lb. first and then 100 lb. twice at intervals of a month; Aegopodium podagraria 500 lb.

Petroleum.—Petroleum is very injurious to plants. Spraying with petroleum emulsions is almost always prejudicial to the leaves and tender branches. The poisonous capacity of petroleums of different compositions differ. The sensibility of different plants also varies whilst the cabbage stands a 5 per cent emulsion, the vine only bears 2·5 per cent and even that injures the cucurbitaceæ. The action of emulsions depends greatly on their preparation: perfect emulsions diffused through much water do not separate drops

of petroleum, that is to say that it does not split up readily and consequently have a comparatively harmless action on the leaves of plants whilst badly prepared emulsions, allowing the petroleum to aggregate on the same point, are in equal doses very injurious. Roots are very sensitive and the absorption of petroleum through them causes the death of the plant: 20 C.C. of petroleum spread up in 4 litres of soil kill the vine, haricots and weeds, such as senecio and sonchus.

Carbon Bisulphide.—This highly inflammable and explosive compound is not in general use as a weed-killer but has proved very valuable in reducing stubborn areas of prennial weeds. Rogers and Hatfield have tried it against convolvulus arvensis and found it very effective. Holes are made in the soil 2 ft. apart and about 18 inches deep in light soil and 2 ft. apart and 24 inches deep in heavy soil, then about 2 oz of carbon disulphide are poured into each hole the holes are afterwards plugged with soil. The poison rapidly spreads in the soil and kills the underground plant-parts.

Effect of weed-killers on the soil.—A question of importance in the use of chemicals for weed eradication is the possibility of such compounds exerting a harmful effect on the soil with risk of injury to the subsequent crop. Some investigations on these lines have been carried out by Bowser and Newton both in the field and green house and under controlled conditions. The liability of damage depends in part at least on the rate of decomposition of the chemical, its rate of movement in the soil and its effect on microbiological activity. Sulphuric acid and copper sulphate which are employed chiefly as leaf-sprays showed no lethal effect on the soil and nitrification was not affected. Sodium chlorate on the other hand, which is mainly used for the eradication of hardy perennials, remained undecomposed for a considerable time—poisonous effects lasting nearly two years after application had been made. The rate of decomposition however was accelerated in the presence of much organic matter, and further teaching removed the toxic compound from the surface layers of the soil, facts which suggest that a shallow rooted crop supplied with a good dressing of an organic manure would be advisible after a sodium, chlorate treatment. Sodium bichromate decomposed rapidly showing no residual toxic effects but both these compounds were alike in exerting a depressing influence on the number of soil micro-organisms.

Entomologists of the U.S.A. Government uphold one popular tradition: Some persons are more attractive to mosquitoes than others. *Science News Letter.*

GENERAL PROCESS OF MAKING JELLY

By A. D. Chand B.Sc. (Ag.); J. A. V.

It is necessary to describe the broad outline of the process so as to indicate clearly, how the underlying principles dealt with previously can best be applied. The process itself is very simple indeed, and any person, following each and every step rigidly may attain very good results, but careless manipulation may discourage even the skilled hands. It must be broug t home to the readers at the very outset, that the process does call for a little experience, a great c re, a presence of mind and patience in order to turn out a very good product.

The process involves the following steps which should be brought into practice in this order.

(1) Selection of fruits.

(2) Preparation of fruits.

(3) Extraction of juice.

   (*a*) The amount of water required for cooking the fruits.

   (*b*) The length of cooking fruits.

   (*c*) The kind of kettle required.

(4) Straining and filtration of juice.

(5) Testing juices for acid and pectin.

(6) Addition of sugar.

(7) Length of boiling.

(8) Skimming and Cleaning.

(9) Testing the jelling point.

Selection of fruits.—For jelly making, our primary requirements are acid, pectin and sugar, and the two former are usually the limiting factors. Since the fruits are at their maximum in pectose and pectin content when they have attained their full size and are just reaching maturity, it is at this stage, that the fruits should be selected in order to produce excellent jellies. It must be remembered that over ripening, mould growth and fermentation quickly bring about destruction of pectin and deterioration in colour and flavour. The colour may be restored by the addition of artificial colours which is done in some countries ; but the loss or impairment of flavour can never he made good.

The jellies can be made even from over-ripe or young fruits, but they lack their natural flavour and colour. The jellies made from over-ripe, rotten and mashed-up fruits can not be kept for a long period, because of the micro-organisms which are introduced through rotten fruits which soon bring about fermentation. So for commercial purposes and specially when jellies are to be exported or kept for long periods they should never be prepared from rotten or even from over-ripen fruits.

In order to prepare jellies more economically, the manufacturer should always be at the look out to secure a good supply of sound fruits from a place wherever they are cheaply and abundantly available. But for home use, where the product is not required to be kept for a longer period; even those fruits which are no longer good for table use can be used for making jam or jelly.

Due to the fact, that the season for any particular fruit is very short and the manufacturers have to stop their plant for the rest of the year. It would be worthwhile that if the fruit expert would try to work out some sort of solution for preserving fruits to prolong the manufacturing period. The measures, that could be possible for Indian climate are the introduction of cold storage, refregeration and the addition of preservatives, but it is still a question of debate; which method would be more economical and suitable for Indian condition.

Preparation of fruit.—The method of preparing fruits is determined from the nature and the texture of the fruits. The soft fruits, such as berries and grapes, need only to be sorted, washed and cleaned of leaves, stalks and other undesireable portions. As they require no additional amount of water, they should invariably be crushed before cooking.

The hard fruits such as guavas, apples, pears, peaches and plums should necessary be sliced before cooking, in order to get rapid and uniform cooking. It is evident, however, that if the fruits are cooked whole, the upper surface would be cooked to pulp, while the inner part would still, remain uncooked. The reason for thorough cooking is that the pectose (insoluble) be converted into pectin (soluble) on which the setting of jelly depends.

Some housewives have the habit of peeling the fruits before cooking; this again is not in accordance with sound principles; because they lose some pectin which is just under the skin of the fruits; and thus get the juices low in pectin and ultimately a poor product.

Fruits like mangoes and peaches should be freed from stones before cooking, because this enables uniform and rapid cooking, although their presence does not impart any undesirable quality to the product.

Extraction of Juice.—Cooking is not only necessary for the extraction of juice, but is also essential to obtain the maximum amount of juice and pectin; because cooking converts pectose into pectin by softening the fruit tissues.

The addition of an adequate amount of water varies with various kinds of fruits. Soft, juicy fruits, such as the gooseberry and blackberry do not require an additional amount of water. Sour grapes may require one-fourth to one-half their volume of water. Such fruits should be crushed before cooking.

In hard fruits such as apples, guavas, plums and pears the amount of water added should be sufficient only to obtain a good yield of juice, with pectin testing to a desirable amount. According to Cruess "Apples require one-half to an equal volume; citrus fruits, because of their long period of boiling, usually require from two to three volumes of water for each volume of sliced or crushed fruits. Fruits which are rich in pectin, such as currants, loganberries, lemons and labrusca (Eastern) varieties of grapes, can be extracted to advantage with two or more succeeding lots of water." It must be remembered, that if more water, than necessary is added, the resulting juice will be diluted and will be so low in acid and pectin content, that it would never form good jelly, unless the juice is again concentrated to a point, where it gives a good pectin test.

The writer, after a series of experiments, has obtained the maximum juice giving a good pectin test, by using the following amount of water, with various fruits.

Fruits.		*Amount of water.*
Fresh roselle	1lbs.	2lbs.
Dried ,,	1lbs.	10lbs.
Guava sliced	1lbs.	2½lbs.
Khatta	1lbs.	4lbs.
Karonda	1lbs.	2lbs.
Gooseberry	1lbs.	1lbs.

The experiments are still being carried on with various other fruits, the result of which will be published on their completion.

The length of cooking fruits is another important step which should be carefully manipulated. It is the length of cooking on which the retention of proper flavour of the fruits in the finished product depends. The fruits should be cooked only long enough to soften the fruit tissues to such a point as to get the maximum juice and pectin. The longer cooking will render the fruit mashy and the resultant juice cloudy, which is hard to strain and clean

and also gives a cloudy product. The juicy soft fruits should be crushed and heated to boiling for about five minutes. It has been experimentally proved that the shorter the period of cooking, the better the flavour retained by the finished product.

Firm fruits such as guavas, apples, plums and pears should be sliced into pieces $\frac{1}{8}$ to $\frac{1}{4}$ inch in thickness. The length of cooking such fruits varies according to the variety and the texture of the fruits. The following length of time, for various fruits has been carefully worked out, by a series of experiments; by this department.

Fruits.	*Length of cooking.*
Apple	15—20 minutes.
Guava	30—40 ,,
Lemon	40—60 ,,
Oranges	0—60 ,,
Kumqual	2 —30 ,,
Gooseberry	5—10 ,,
Karonda	10—15 ,,
Roselle	15—20 ,,

Kettles used for cooking.—There are many fruit and vegetables which contain a good deal of acid, such as tomatoes, mangoes, sour apples, and sour grapes and the tendency of the acid is to react with certain metals. The strength of the reaction varies with the strength of the acid and the kind of metal with which it comes in contact. Still there are certain metals which are not acted upon by acid and specially by weak acid. Certain chemicals, so formed, are deadly poisonous, some are harmful and the others are injurious on accumulation. It is therefore a matter of greatest responsibility and importance, for all the manufacturers, to be very careful and cautious in selecting the kettles for cooking fruits or boiling juices; otherwise they shall have to pay dearly for their negligence if any loss of life is caused by their product.

The fruits cooked in copper kettles not only become injurious, but also lose their lustre, colour and flavour. To be on the safe side and also to avoid such losses, aluminium kettles should be preferred for a large number of fruits. For all purposes, the best kind of kettle is the glass-lined. They are specially good for those fruits which are high in acid content and require longer periods of cooking or boiling.

Straining the juices.—The last drops pressed out from the

cooked fruit are, no doubt, higher in pectin and acid content and it is a general practice amongst the manufacturers of jelly to squeeze the pulp to its last drop; but it is undesirable because it makes the juice cloudy and the final product too is rendered cloudy.

In order to make the final product attractive, clear and sparkling, the best method is to transfer the cooked fruit to a thick cloth bag and allow the juice to drain and drip, itself, without the aid of pressing; into a receiver, which is placed under the bag. If all the ingredients are required to be extracted, the residue may be reboiled with just a little amount of water.

Filtration.—'ome juices, such as the juices of citrus fruits are popular for their cloudiness and they remain cloudy even after careful filtration. Most juices, if strained through thick heavy cloth bags or felt, need no further treatment. Only those juices which cannot be filtered by these methods, should be treated with any electrolytes, such as alum solution, dilute milk solution or infusarial earth.

Juice testing for acid and pectin.—Every juice before boiling should be tested for acid and pectin, according to the method previously described; in order to be sure that the juice will produce good jelly. If this step is missed or over looked, the chances are that the product may never set at all or may be of very poor quality. So it is worth while, that every manufacturer should take the trouble of testing every lot of juice in order to guard against losses. In case the juice is found poor in acid or pectin, he will be in a position either to blend some other fruit rich in acid or pectin or to add commercial acid or pectin to get a good product.

Addition of Sugar.—There can be no rule of thumb recommendation for all jelly stocks as regards the addition of sugar, because the sugar requirement is apt to vary with the following factors.

(*a*) Sugar content of the fruit.

(*b*) The acid and pectin content of the juice.

(*c*) The amount of water used for cooking the fruit.

(*d*) The length of time for which the juice is kept after it is cooked and strained.

The best jelly will only form when the concentration (specific gravity) of the solution of sugar, acid and pectin equals or exceeds a certain maximum point, which varies according to the relative proportion of pectin, and acid present in the fruit juices.

Although fruits do not contribute much sugar to the juice, still in certain cases, it is sufficient to throw the relative proportion out of balance and cause serious losses in the final product.

The amount of acid and pectin in the juices has the greatest bearing on the sugar reqirement. As a general rule, a greater proportion of sugar is added to juices which are rich in both acid and pectin than to those deficient in one or both of these, in order to get the maximum yield.

The proportion of sugar required also varies with the amount of water used when cooking the fruit. If a large quantity of water is used, the essential constituents are diluted and the juice becomes poor in acid and pectin. In such cases, less sugar must be added, allowing a sufficient margin for concentration of the juice or the juices must be concentrated to a desi·able quantity before adding sugar.

It has also been found out that if the juice is left overnight or even longer after its extraction, sugar, acid and pectin hydrolyse to a certain extent, leaving the juice poor in essential ingredients. The manufa:turers should therefore keep all these factors in mind before finally deciding the amount of sugar they require for any juice with which they are working.

From the writer's experience the following proportions of sugar are adequate for getting the maximum yield.

Fruit juices.			*Amount of sugar.*
Guava juice 3lbs.	...	...	2lbs.
Roselle 3lbs.	...	...	½lbs.
Roselle 1½lbs. guava	1½lbs.	mixed	2½lbs.
,, 1½lbs. tomatoes	1½lbs.	,,	2lbs.
,, 1½lbs. Ber	1½lbs.	,,	2lbs.
Karonda	3lbs.		3lbs.
Sour plums	3lbs.		2½lbs.
Loquat	3lbs.		2lbs.
Sour grapes	3lbs.		2½lbs.

Length of boiling.—The length of boiling is the key note on which the success depends. The main purposes of boiling are:—

(*a*) To dissolve the sugar.

(*b*) To bring sugar, acid and pectin to a harmonious union to form jelly.

(c) To concentrate sugar to a point where jelling will occur.

(d) To cause the coagulation of certain organic matters, which floats on the surface in a mass, and should be removed while the juice is boiling.

In order to obtain excellent jelly, the boiling should be rapid, uniform and for as short a time as possible. Simmering on a slow fire keeps the lower part more agitated than the surface layer bringing the lower part to a jelling concentration much earlier than the surface layer, thus causing an excess amount of evaporation before the whole mass reaches the end point and ultimately decreasing the yield. The same is true if the juice is boiled in a very thick layer, *i.e.* if larger volume of juice is used. The thickness of the layer should be such as to allow boiling uniformly and rapidly.

Prolonged boiling apart from being injurious to flavour and colour may also cause hydrolysis of pectin to pectic acid and alcohol, in which case the jelling may never occur. Prolonged boiling not only causes hyrolysis of pectin, but in the presence of fruit acid, it also brings about inversion of sucrose (cane sugar) to fructose (levulose) and glucose (dextrose) $C_{12}H_{22}O_{11} + H_2O = C_6H_{12}O_6 + C_6H_{22}O_6$.

(Sucrose) + (water) = (fructose) + (glucose) and this is a frequent cause of failure in manufacturing jelly. It has also been noticed that the jelly cooked for a longer time is less liable to develop crystals, than that cooked for a shorter period, assuming that both are cooked to the same concentration.

Skimming and cleaning.—From properly filtered juices much of the organic matter is removed and whatever is left, coaguates during boiling; and floats on the surface. The sugar too, no matter how pure it is, always contains certain impurities, which also rise up on the surface during the process of boiling, which can very easily we skimmed off by means of a spoon.

For thorough cleaning, electrolytes such as alum solution calcium chloride or milk may be added while the juice is boiling. These will precipitate the organic matter, which will come up to the surface and can be removed.

Determination of Jelling point.—The jelling point may be defined as the concentration of acid and pectin and the ratio of sugar to acid and pectin to such a point at which the desired texture is formed. From the definition, it is evident that the interpretation of the end point is not a definate one. The end point will therefore vary with the definition of jelly which the manufacturer has preconceived. A house wife, may call a soft jelly an excellent jelly and a manufacturer who sells his produce locally

may like it slightly stiffer, but the one who ships his products to other countries or stores for longer period would certainly make it much stiffer than those mentioned above; so that his product may be better able to stand rough handling.

In general, for the determination of the end point correctly; the definition of jelly described in the beginning of the chapter must be kept in mind.

The most common method used to determine the end point by the manufacturers is, to take a little boiling liquid in a spoon cool it and allow it to run down from the side of the spoon, if it drips like a thin syrup, the process is incomplete, and if it breaks off partially coagulated, it is nearing the end point but if it forms a jelly-like sheet on the side of the spoon, the boiling is considered to be complete. But even this test is subject to errors, because of the personal equation and also due to different behaviour of the different juices.

The end point is also determined by dripping a drop of boiling liquid into a saucer containing a little cold water. If the drop coagulates in a thick mass, the boiling process is complete.

A more accurate means of determining the jelling point is, by means of a thermometer. Most jellies jell between 218° to 222° F. According to the writer's experiments the following fruit juices have given excellent jellies at the following temperature.

Fruit juices.	End point.
Guava	223°F.
Roselle and guava mixed	221°F.
Roselle and tomato mixed	222°F.
Roselle and ber mixed	2[illegible]2°F.
Roselle	220°F.
Karonda	218°F.
Sour plums	220°F.
Sour grapes	22[illegible]°F.
Loquat	220°F.

"Of primary importance is the consideration that the permanence of fertility in a soil varies with its content of minerals which are still liable to decomposition. A soil having a high content of such minerals is, other things being equal, better than a soil with no mineral reserves". *Dr. P. Vageler*.

THE SQUAB INDUSTRY

By Rashid A. Munshi, B. Ag. Dip: Forestry (N. Wales)

It has been possible to start with a few dozen pairs of birds, young and vigorous, as parent stock and to demonstrate the importance of Squab-breeding. Apart from economic considerations I have been concentrating on research in breeding for hereditary characteristics so useful in the production of rare plumage and colourations. The breeds so far being reared and concentrated upon are as follows :—

Utility Pigeons :—

(*a*) The Deccan Carneaux.

(*b*) The Deccan Blue Rock.

(*c*) A few suitable crosses and

Fancy Pigeons :—

(*a*) Jacobins.

(*b*) Holle Cropper

(*c*) Oriental Frills.

These breeds are vigorous, hardy and adaptable to any change of climates or locality. They produce healthy Squabs with prime white meat.

The Table-breeds have been evolved out of our local bazaar lofts and apart from Yellow, Copper, Red and Blue we have also suitable crosses giving checkers, etc. Their size, quality and colour of meat and prolificness are other qualities worthy of note.

As regards fancy breeds, we have quite a decent selection from Oriental Frills, Jacobins and Holle Cropper. These provide interest and money for the common breeders of pigeons and a few of these beautiful birds are always welcome in a section of a Squab-plant They serve as a variation if nothing else. A farmer possessing 1½ dozen pairs of active working pigeons can secure 16 squabs per month or 60 pairs would give him 55 squabs per month or an income of Rs. 10 or 12 p.m.

In the Deccan a majority of the people do possess some good working stock but due to the traditional notion of the sacredness of pigeons they seldom sell to hotels, restaurants or private meat consumers. Needless to say it is waste of time and money with them.

(1) *Lines of Work :*—Life histories of different breeds should be studied as these lead to ways and means of increasing prolificness and longivity of working parents-stock of pigeons.

(2) *Sterility amongst Pigeons* :—The sterile characteristics of certain breeds is somewhat bred out of foreign blood mixtures. The Indian breeds are still primitive and are often slaves to that instinct to a great extent. It is nuisance in the aviary especially in extensive Squabplants. During a season, a pair of Dragoons, Scandaroons, or Carneaux, King or Mondains should give a pair of squabs a month but these are neglected here and seldom produce every two are three pairs of squabs during the whole year.

To prevent sterility greater spacings in the lofts, prevention of crossings with undesirable breeds, hygienic and clean feed, are some of the factors to be taken into consideration. Suitable data are still to come forth but in the Deccan especially the Sathe breeds show degeneration, are shy to breed and difficult to rear for squab production. For the present, however, those are the best breeds to work with since others we find meagre and small in size.

(3) *Size of the Squab plant* :—It is seen that a man after his working hours could easily manage a small squab plant made out of ordinary teak boxes and crates and holding 1½ dozen pairs of parent-stock birds. This is also seen in our common bazaar lofts. I should however suggest, 'Unit houses' after the suggestions of Messrs. Plymouth Rock Squab Co. Melrose. A unit-house measures $16 \times 12 \times 8$ with a netting-run of $20 \times 12 \times 8$ attached to it and holds comfortably from 50 to 60 pairs of birds. 2″ mesh netting is best. It is cheap and can be secured in, from one to six foot rolls. There is no need of any heavy structure. Pigeons would work in almost any place, if it is free from rats, darkness, and dampness.

(4) *Sites and localities* :—Poultry and pigeons are akin to each other in many respects and it is obvious that squab plants could easily be installed wherever poultry has been. Back yards of houses, patches of waste land near agricultural plots, open spaces under trees, old and dilapidated farm houses are some of the ideal places to start pigeonary. The importance of the squab industry is steadily gaining ground and pigeons find ready markets in our local bazaars, hotels and restaurants near railway stations.

(5) *Squab-production and yield* :—This vies according to localities, breeds kept, season and size and number of unit houses. As a general rule a strong, vigorous working pair of pigeons produces to 10 pairs of squab every year. In practice however a pigeon may breed only 4 to 5 pairs of squabs a year. Thus it would be safer to have pure home-bred ones rather than those from the street lofts. Carneaux, Kings, Mondains, etc. show large breasts and lung capacities, muscles set hard and firm and above all possess homing qualities. These breed fast and true.

(6) *Breeding* :—It is seen that in theory eggs hatch in 17 days and the female lays eggs again when young ones are only 2 weeks old, thus a pair of squabs a month. An example : Taking 12 pairs of pure-bred pigeons, they would breed during

1st month	...	... 24 squabs
2nd ,,	...	... 48 ,,
3rd ,,	...	... 72 ,,
4th ,,	...	... 96 ,,
5th ,,	...	... 120 ,,

Here now the first lot of squabs which we got in the first month are again ready to mate and lay eggs so at the end of the

6th month	...	... 168 (144+24)
7th ,,		
12th ,,	...	... 960

and this is the number of squabs got in one year, but in practice, as stated before, one may have only 7 to 10 squabs per year instead of 12 to 14 pairs and hence it is always advisible to have strong, vigorous and active breeders rather than those from the street lofts.

In foreign countries we have Runts, Carneaux, Kings and suitable crosses from Maltese, Hungrians and Strassers breeds. Here one finds suitable crosses from Sathe breeds and pure Sathe breeds. Unfortunately, Sathe breeds lose their characteristics on crossing. They are recessive and hence selection for better strains is necessary.

(7) *Scheme*:—

(*a*) Breeding and hybridisation

(*b*) To study different breeds, their prolificness, sterility, homing qualities, seasonal management, mating, squab-production and diseases if any.

(*c*) Economic utility, to off-time workers, hobbyists and those interested in side and cottage-Industries.

(*d*) Production of squabs, canned meat, egg-powders and feathers for millinery.

(*e*) To establish centres for the squab industry, especially wherever poultry stations have been established.

(*f*) Introduction of short courses on the squab industry, a small section along with poultry classes is essential.

(Appendix B.)

Appendix A

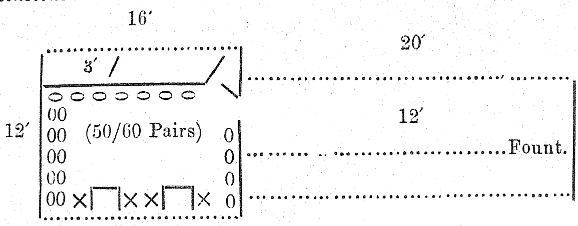
Unit-Houses.—These could be managed by a single person.

The house has windows and perches on one side of the wall, while the other three sides of the room are meant for nests and nest boxes.

These perches are set 15″ apart for resting and so arranged as not to soil the bird nesting beneath.

Wire netting of 2″ mesh is best.

Dimensions :



South Side.

Height 8′ and
Length 16′
Breadth 12′
Nesting shelves ⊂⊃ ⊂⊃
Roosts on S. Wall. × ×
S. Windows 2. (3 × 2).
N. Windows 1. (3 × 2).
Doors 3′.

		Rs.	a.	p.
Expenses :—	60 pairs of pigeons	280	0	0
	Nest-boxes	25	0	0
	Roosts	5	0	0
	Netting	25	0	0
	Feeding troughs	10	0	0
	Killing Machines	15	0	0
	Hand bucket	2	8	0
	Catching net	1	0	0
	Rs.	363	8	0

Income :— If $1\frac{1}{2}$ dozen pairs yield 16 squabs per month 60 pairs could easily give 55 squabs per month.

	Rs.	a.	p.
Taking for granted, price Rs. 6 to 8 annas each	25	0	0
Feed for 60 pairs :	5	0	0
Rs.	30	0	0

Net Income per month.

Appendix B.

Short-Course:—The proposed course comprises studies under the following heads and sections :—

Section 1.

Pigeons as hobby.
History of pigeons.
Pigeon rearing.
Life histories.
Pigeon lofts.
Breeds: Fancy.
Racing and
Squabs.

Section 2.

Importance of squab industry.
Poultry Vs. pigeons.
Unit-houses.
Nest bowls and nests.
Feed, mating and hatching.
Breeding principles.
Increase of flock.

Diseases.

Killing and cooling processes.
Plucking.
Drawing.
Trussing.
Canning.

Markets and marketing methods.

Shipping boxes.

Crates.

So far as I know there are very few standard text-books on the squab industry but

(a) *The National Squab-book.*—by Messrs: Plymouth Squab industry Melrose Mass: and

(b) *Indian Pigeons and Doves.*—by E. E. Stuart Baker F. Z. S. Rs. 37-0-0

are quite good. They also show innumerable illustrations of Unit-houses, Killing machines, Table breeds etc., etc.

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1. NOTES FROM REV. J. BUCHANAN M.D., D.D. AMKHUT, C.I. Four cultural white leghorns, while laying all through the rains, since October when eggs were carefully gathered, have averaged 22 eggs each for the six months, *i.e.*, 528 eggs mostly of A1 size, 5 tolas.

One could retire in India with 4 such hens, a Sindh cow, a Surati goat (the poor man's cow) and a second-hand Ford with comfort.

2. One setting of 12 eggs brought out 13 chickens.

3. One well formed single yolk egg weighed just under $9\frac{1}{4}$ tolas.

Daughter Ruth, a real sport, sent it to the Ali Rajpur Raja Sahib. He was so tickled he made a 30 mile trip through the jungle to see the fowls. He, the Raja, a Sir *begged* and got a hen.

4. One pullet, coming into laying, developed "Prolapse of the Oviduct".

We followed Mrs. Fawkes' method by olive oil gently pressing and replacing, using injection of strong cold tea, the dark room, light food etc. All to no avail. The promising young pullet was in such misery for 4 days that we thought she would have to be destroyed. Then, as a medical man, I thought of the knee breast position in case of human prolapse. So I had the fowl's legs tied with soft cloth and hung her up in the dark room. Instead of this being cruel, it was the only way in which the poor bird could get any comfort. She was left up three hours at a stretch, a real relief, let down for light food and water, then hung up again. She began to improve at once and has lately commenced laying again. The Bhil Christian boy Ruth is training, on the first sign of prolapse now intelligently hangs her up for a spell to her comfort and cure.

COMPOST

[By S. R. Misra.]

The value of manure in crop production has been recognised, and manuring has been practised in India from the earliest times. Manuring is done even now by the general cultivator to a greater or less extent, mostly because it has been done as some other practices have been followed in agriculture, understanding but little the scientific aspects of manure and manuring practices. This fact is mainly responsible for the very careless treatment of the little existing supply of manures in Indian villages. Consequently the Indian farmers suffer in two ways, that is, by the insanitation of the village, and the minimum returns of such badly treated, leached manure when used in crop production. Every year millions of tons of food, fodder and money crops are produced and taken off the Indian soil which is consequently robbed of a huge amount of plant food every year. No corresponding amount of plant food is restored to the soil to counter-balance this depletion of soil fertility. Such a system of rather exploitive farming for a fairly long period has greatly reduced the capacity of a major part of India's cultivated area for maximum production. The place of legumes in the rotation of crops, and the practice of fallowing are happily some of the few healthy practices in our system of agriculture which have been putting off the evil day of complete bankruptcy of the Indian soil's fertility. Then there is the practice of burning cow-dung cakes which is certainly a great economic loss to the country. Many of the agricultural reformers spare no emphasis in denouncing it but unfortunately this practice is so deep-rooted and inseparable with the daily household necessity that in absence of as cheap, readily available and adequate (slow burning) substitute for dungcakes in most villages it seems a vain entertainment of hope that burning of dung-cakes will be abandoned in any near future. So the real manurial problems here are twofold; firstly to establish a system of manurial preservation whereby all possible manurial losses be reduced to minimum, require least technical or scientific knowledge and be cheap and readily available so as to be within the means of an average Indian cultivator; secondly, this system be such that with the existing supply of fresh manure on any agricultural holding, a greater quantity and better quality of manure be prepared so as to make economically possible the use of part of fresh dung as fuel. The compost system of manufacturing artificial farmyard manure holds out a great promise to meet the above requirements in India.

We at the Institute farm have had compost system for several years. Our annual supply of farmyard manure consists of about

900 cartloads or about 500 tons of solid fresh dung from livestock and roughly about 400 tons of stable beddings, fodder and silage remnants. In addition we haul in about 500 to 700 tons yearly of sullage screenings from the local municipal sullage pumping station. This is mostly used for direct manuring whenever possible; otherwise it is put on the compost. Then we also put on the compost all farm refuse such as brinjal, tomato, mustard stalks, all unedible weeds, potato, pumpkin vines, rotten vegetables and silage, roadside leaves and soon we have about half a dozen of compost heaps at different places on the farm. The compost heaps are always located firstly near an irrigation channel, wherefrom a boy with a bucket can throw water on the compost whenever needed, as the presence of moisture is essential for thorough decomposition of the compost; secondly, they are on the road-side where daily hauling of fresh manure is convenient; thirdly they are on the side of a field which needs manuring because the distance of hauling the finally composted manure to the field required is reduced to a minimum, and because whenever a heavy downpour of rain occurs, the unavoidable washing of the manure heap is drained directly into the field and absorbed by it. Then we have a man with a manure-fork all the year round for turning up and down all compost heaps. The forking or turning of compost requires a certain amount of skill and is done in a definite order. Each compost gets about three turnings before it is completely ready for applying to a field. We have mainly two seasons for the application of this manufactured farmyard manure to fields, one before sowing the Kharif (rainy season) crops the other before sowing Rabi (winter) and potato crops. It will be seen how that with about 500 tons of fresh dung and waste farm products we prepare about 800 to 1,000 cartloads of well decayed friable manure ready to be incorporated into the soil and be readily available to the crop. This manure has a much greater value and covers a greater area than in its fresh state.

The whole period of composting consists of three main processes: Charging the manure pit or building up the compost heap, manufacturing period or decaying process of the compost and handling the finished product.

The size and number of manure pits or heaps should depend on the size of an agricultural holding, and the supply of fresh manure and waste organic materials. A convenient dimension of a compost pit is recommended by Mr. Albert Howard as 30 feet long, 14 feet wide and 2 feet deep. The most satisfactory depth or height of a compost is said to be 2 feet. The dimensions may be varied a little bit according to particular needs. However, the depth of a compost must not be more than 3 or 4 feet. During the rains the pit system is not desirable. Fresh farmyard manure and

organic refuse should be spread evenly in alternate layers. Too woody materials like brinjal, arhar, cotton, sannhemp, mustard stalks should be broken by running over it a bullock cart or a stone roller, and too green materials should be dried a little before putting them on the compost. If too dry, some water should be sprinkled on each layer. A layer of plant residues should not be heaped up by a thick layer of fresh manure as this results in too close packing of the materials. The compost should be loosely heaped. All stall urine, urine-earth, ashes and house sweepings should be collected and sprinkled on each layer. When the compost is full, it is ready for the second process—the period of decomposition. Any fresh manure or plant residues must not be added to it any more. Another fresh compost should be started.

In about three or four months the compost is thoroughly decayed. During this period the compost should be turned or forked top to bottom about three times. The compost should always be kept moist by sprinkling some water whenever required but it must not be too wet or too dry as both conditions are harmful. Besides ensuring thorough admixture of the various materials forking or spading also maintains looseness of the mass and so allows adequate aeration in the compost. Aeration, a suitable degree of temperature and moisture, the presence of a basic substance are indispensable for thorough nitrification and docomposition of the compost. Nitrifying bacteria are strongly aerobic. When aerobic conditions are checked by a heavy downpour of rain or compactness of the compost, a reversive process takes place. Denitrification results. Whenever a bad smell comes out of the compost and too many flies sit on it, it is an indication that anarobic conditions (putrifaction-denitrification) have set in and the compost must immediately be turned. The breaking down of cellulose or woody materials is also carried on by certain bacteria and fungi under aerobic condition. The addition of wood ashes and urine earth is a very economical way of supplying a basic substance in the compost. In India we do not have to worry much for temperature. During the rainy season sometimes over saturation of the compost takes place but about a couple of days after a heavy torrent of rain passes off, normal conditions establish again in the compost. A systematic worked out time table for the compost given by Mr. Howard is as follows :—

Day.	*Event.*
1	Charging begins.
6	Charging ends.
10	Fungus growth established.
12	First watering.

Day.	*Event.*
16 } 17 }	First turning, compost innoculated from another pit thirty days old.
24	Second watering.
30 } 32 }	Second turning.
38	Third watering.
45	Fourth watering.
60	Third turning.
67	Fifth watering.
75	Sixth watering.
90	Removal to field.

Shading of the compost is not necessary and economical for compost under Indian conditions.

The finally composted manure is light black perfectly decayed and quite friable and free from clumps. It has no bad smell. It is a plant food prepared outside the field and becomes readily available to the plants when applied. When ready, the compost should not be left long unapplied to the crop as then loss of its nitrogen content occurs. If a proper mixture of all vegetable wastes has been used (having a carbon nitrogen ration of about 33.1) the composted product forms an all round manure having a carbon nitrogen ratio in the neighbourhood of ideal proportion of 10-1. So a fair use of fallen tree leaves and other nitrogenous materials should be made in the compost. "Pound for pound compost manure is richer in plant food than fresh manure, because if properly cared for, nearly all of the nitrogen phosphoric acid and potash of the original manure are present in the smaller bulk. A ton (2,000 lbs.) of composted manure is obtained from about 2,80 pounds of stable manure." Mr. A. Howard says " fifty cart-loads of ripe compost per pair of oxen per annum can be made from the plant residues available on any holding. The quantity can be more than doubled when all the dung and urine earth are used, provided of course sufficient vegetable refuse can be secured." He further says "the fact that the cultivator really requires only a fraction of his cow-dung for converting all his vegetable wastes into humus, disposes once and for all of the view that the salvation of Indian agriculture lies in substituting some other fuel for cow-dung cakes. As no other suitable fuel exists in many of the villages of India, cow-dung must be utilized. Fortunately, when all the available vegetable wastes have been converted into humus, a large supply of cow-dung for fuel will still be available. The ashes however

(Continued on page 190.)

THE SUMMER SCHOOL OF RURAL RECONSTRUCTION AT ANKLESVAR

BY EDWARD K. ZIEGLER.

A unique summer school was held at the Vocational Training School, Anklesvar, Bombay Presidency from April 20 to :7. Refresher Courses for educators, Spiritual Life Conferences for preachers, and conventions of many other sorts are the order of the day, but this was a summer school for farmers. It was the second to be held at this great centre of practical agricultural training. A small beginning was made last year, but by this year it had become a lusty infant indeed.

For several months, Mr. A. S. B. Miller, the Rural Reconstruction Missionary of the Church of the Brethern, had been making careful plans, and had been tirelessly urging farmers to come, and carefully picking a staff of teachers. Anklesvar was chosen as the centre because of its fine traditions of agricultural and vocational training, its practical demonstration of the best methods of rural uplift work, and good accommodations for all who might come. The school was not subsidised. All who came, whether farmers, teachers, or others, came entirely on their own expense, and acted as if they were getting far more than their money's worth

Who were the students? About fifty attended the classes. Of these, there were more than twenty actual dirt farmers, men who came to learn how to do things on their own farms, some of them educated, others not. Then there was a group of about fifteen made up of rural teachers and preachers, who were just as eager to learn and to get practical ideas to carry back to the villages as the farmers. The rest were the young lady teachers and some students of the School of Practical Arts, which is just a half-mile away. Some of these men had come as much as eighty or ninety miles, even though the frost had destroyed their money crops, and came cheerfully at their own expense.

The programme of the summer school was planned to meet all aspects of village life. The following glimpse of a day's programme will indicate the range of interests dealt with:

6-30—Morning Prayers, with the Training School Students.

7-00—Practical work. (Actually done)

Group 1. Poultry Feeding and care.

Group 2. Constructing Bore-Hole Latrine.

Group 3. Soap-Making, or Making Itch Medicine.

(Students were given time in each of these groups so they could get some experience of doing each kind of work.)

8-00.—Deepening of the Spiritual Life. (Prayer, Village Worship, Stewardship, Christian Village Home Life, Christs' Message Concerning Frosts, Earthquake, Illness, etc. and Clean Living.)

9-00.—Poultry Keeping, alternating Co-operative Credit Society Work.

10-00.—Agriculture. Lectures and Discussions by the Agriculture Teacher of the Vocational Training School, a farmer by inheritance, training, and inclination.

11—3-30.—Noon Meal and Rest.

3-30—5-30.—Cattle Judging, Cattle Feeding, Goat-keeping, Egg Packing and Marketing.

5-30.—Recreation. And how those farmers did *play* ! Fine sportsmanship, and genuine enthusiasm. Nor did preachers hold back !

7-30.—9-30.—Camp Fires and Inspirational Addresses.

This daily programme was carried through eight days from Saturday to the following Saturday. Easter Sunday was a day of real worship. The morning service was held in the beautiful Acklesvar Church, with the local congregation. The chaplain of the summer school, Mr. Ziegler, conducted this service, as well as the morning worship periods each day and the hour on the deepening of the Spiritual Life. On Easter Evening one of the village preachers led a vesper service out under the sky with an unusually superb sunset giving added grandeur to it all.

The success of this school and the deep interest which every farmer and student took in it are very largly due to Mr. Miller's tireless efforts. His vision and his perseverance have wrought a real change in the atmosphere of the church in a large area. The preachers, teachers, and farmers are all uniting in a common programme of service, and this summer school was a long step forward in strengthening that movement.

With Mr. Miller were associated a group of men with vision and enthusiasm who made splendid contributions also. Mr. Patel, the teacher of Agriculture at Anklesvar Eshvarlal Loraji, who has made a fine effort at poultry-keeping along with teaching a fine village school; Rev. Devji Ramji, who is an ideal combination of rural pastor, farmer, and village reconstruction worker ; Mr. Bhatt, Scout Commissioner of the North Division; Messrs. Moosaw and Bhagat of the Vocational Training School, and others.

This was a school without findings, in the formal sense. After the certificates were awarded, the men expressed their gratitude and their determination to go home and do something about it, their eagerness to have another school next year, the school was over. Mrs. D. J. Lichty, of Anklesvar, presented the certificates. An institute for village women will be held later.

REPLY TO QUESTIONS

S. Bashir-ud-din Ahmad, Khan Bahadur, Bashirganj, Cawnpore:—I shall be extremely obliged if you will let me know the method of preparing "Blood meal," "Alfalfa meal" and "Clover meal" for feeding poultry. I see in various books that such feeds are very valuable, but I do not know what exactly they are—I am inclined to think that blood, alfalfa or clover if boiled along with other things to be used as a mash will become a meal.

Before I start to answer your question let me say a few lines regarding poultry feeding.

Unlike cattle, sheep, etc., poultry can utilize little roughage because of the nature of their digestive tract. Even then, poultry needs the three types of feeds namely:

(1) Carbonaceous concentrates.

(2) Protein rich concentrates.

(3) Succulent feeds and roughages.

Carbonaceous concentrates:—Wheat, Bajra and Barley.

Protein rich concentrates:—Meat scrap, Fresh meat, Waste meat (offals), Butter milk, Wheat bran, etc.

Succulent feed and roughages:—Alfalfa or lucerne, clover an other legumes are usually grouped under this.

Our Institute method of feeding to satisfy the above requirements is given below:—

To furnish carbonaceous concentrates we give a mixture of 2 parts of wheat, 3 parts of bajra and 1 part of barley. About one ounce to two ounces of this feed is given per bird.

To furnish protein rich concentrates we make what is called a wet mash. Equal parts of ground wheat, wheat bran, ground barley, and ground juar is taken and mixed well. With this a mixture is made with cooked waste meat (offals) without salt and chopped well with a meat chopper in a proportion of 2/3rd the former and 1/3rd the latter. To the complete mixture 3 to 4% of ground lime stone is added.

To furnish succulent feeds and roughages we give green alfalfa or lucerne. We hang them in one or two places in the poultry pen. We keep about a lb. of it for about ten birds.

Besides the above feeds poultry should have access to clean sand and ground lime stone.

In answering your question I should say: Blood meal is nothing but dried blood. It is a good feed for calves and horses and seldom given to poultry.

Alfalfa meal is ground alfalfa hay. Since alfalfa is a leguminous plant it is often used in western countries during winter when green feed is not available as part of dry mash to increase its bulk. Also steamed alfalfa hay may be used temporarily as a substitute for succulent feeds.

Clover meal.—Clover is another leguminous plant which is not grown much in this country. Berseem or Egyptian clover and "Senji" or Bitter clover are usually grown here. Its meal is prepared in the same manner as alfalfa meal. There is practically little difference in food value between alfalfa meal and clover meal although experience in west countries shows that poultry prefer clover to alfalfa hay.

M. J. Z.

Procedure for Making A Bonemeal Compost.—Mix together very thoroughly the following :—

	20 Mds. Bonemeal.
	40 Mds. Sand.
	5 Mds. Sulpher.
	4 Mds. Charcoal.
about	5 Mds. Water.

The compost heap should be made on a solid floor and under a roof so as not to be reached by rain.

The compost should be watered every week or two weeks depending on the season, dryness of the atmosphere, etc. Enough water should be added to keep the compost moist all the way through but an excess of water is to be avoided as it would drain off carrying with it disolved phosphate.

The period of fermentation should be six months.

The application of about 75 to 100 lbs. of ripe compost per acre should be sufficient.

"Not all butterflies are short-lived: Some live almost a year in the adult stage, though they hibernate part of this time". *Science News Letter.*

"It is hardly too much to say that more than 75 per cent. of all failures in tropical and subtropical countries are due to the choice of unsuitable land". *Dr. P. Vageler.*

RURAL HOME SECTION

Courtyard Gardens

[CONDUCTED BY MRS. SAM HIGGINBOTTOM.]

Nearly every Indian home has a courtyard (*angan*) sometimes only 6 or 8 ft. square. In nearly every courtyard there is a stack of manure cakes, (kundies) fuel for cooking. Besides there is usually a pool of dirty stagnant water. Suppose we combined a few kundies in the soil of one corner of every *angan* and soaked it with the stagnant water and put in vegetable seed what would we get? Less sickness because of a smaller wet breeding place for flies and mosquitos; a few fresh vegetables to add to the unbalanced and monotonous diet of most village families, and someone made happier by having a useful constructive occupation. If that someone were a young girl it might keep her in better health from the exercise and an interest.

India needs vegetables and no place on earth can better vegetables grow with little effort. Day after day in the United Provinces in almost every village home the diet is "dal roti" (pulse soup and chapaties, or whole wheat unleavened bread). It is good food, nothing tastes better when one is hungry and tired. But it is not a balanced ration and when growing children are fed only that, they dwarf and are susceptible to disease. Tuberculosis growing and spreading fast in India finds good soil in young people fed only on that.

Babies who are weaned from mother's milk die like flies in villages where good cows or goats are not kept. How often one finds in a village a large herd of cattle but hardly a cow giving milk during the hot weather. Suppose in such a village babies could be fed with water from boiled vegetables containing a little of the mashed vegetable, tomato juice, rice water containing salt, sugar and lemon (or lime) juice besides dal soup! I believe many of those babies could live. We have had tomatoes growing in our garden in May. I believe were they partly shaded and protected from the hot wind and well-watered they would continue through May. Loukis and cucumber could be grown until the rains.

In the U.S.A. where food *values* have been studied and tested to a great extent the proportion of vegetables eaten is high.

In New York markets fresh vegetables and fresh fruit in the proportion of 1 lb per person per day are sold.

In London the proportion is 4 oz per porson per day.

In Bombay the proportion is ½ oz per person per day.

Study the death rate of the various countries and one can see vegetable and fruit diet adds to longevity.

How can we get India on to a fresh vegetable diet?

My answer is—Courtyard Gardens.

In the Leper Asylum each person able to do a little work has a garden plot. It is very remarkable the amount of vegetables obtained from each. Hardly a day goes by when most of them cannot have some vegetables added to their dal roti. In another issue I will try to give the size of these plots and the amount and variety of vegetables grown. Now during the rains papita trees can be started and in 12 months green papayas can be used for vegetable and in 18 months the fruit.

Let us as staff, graduates and present students of the Allahabad Agricultural Institute start a campaign for "Courtyard Gardens."

ETHEL CODY HIGGINBOTTOM.

(Continued from page 184.)

should be carefully collected and employed as a base in the compost process." The dosage of composted manure per acre depends on the nature of the soil and crops to be grown. For general purpose it may be applied about 20 cart-loads (8 to 10 tons) per acre. For crops like potatoes, sugarcane, vegetables, heavier application will be needed. As a rule, it is better to make light applications at shorter intervals than heavy ones at longer intervals. Well rotted composted manure improves the soil chemically physically and bacteriologically.

S. R. MISRA.

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METEOROLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE

April, 1935

Date	Maximum Temperature.	Minimum Temp.	Mean Temp.	Percentage of Humidity.	Atmospheric Pressure	Rain for the day.	Rain since Jan. 1	Wind direction.	Remarks.
1	92	62	77·0	38	29·62	Nil	1·51	W.N.W.	Land levelling upto the 17th.
2	93	63	78·0	32	29·58	"	"	S.E.	
3	94	66	80·0	60	29·64	"	"	S.E.	Collecting road side tree leaves to be used as bedding for oxen and then to be removed to compost heap.
4	93	67	80·0	72	29·59	0·12	1·63	N.	
5	89	67	78·0	74	29·58	0 01	1 64	E.	
6	91	68	79·5	69	29·57	0·01	1 65	E.	
7	92	69	80·5	60	29·56	Nil	"	S.S.W.	
8	94	70	82·0	52	29·55	0 02	1·67	W.	Irrigating Banda and Bajra for summer fodder.
9	95	70	82·5	48	29·50	Nil.	"	W.	
10	95	71	83·0	48	29·46	"	"	W.	
11	94	67	80·5	42	29·46	"	"	W.	Sale of potato and other vegatables continued.
12	95	71	83 0	50	29·50	"	"	S.S.W.	
13	95	70	83·0	40	29·50	"	"	S.	
14	96	74	85·0	41	29·45	Trace.	"	W.	
15	94	72	83·0	44	29·45	"	"	E.	
16	92	70	81·0	40	29·54	Nil.	"	W.	Ploughing of land after Rabi harvest for next Kharif crops.
17	95	69	82·0	32	29·61	"	"	N.	
18	06	68	82·0	34	29·61	"	"	B.N.W.	
19	95	74	84·5	32	29·58	Trace.	"	N.W.	
20	98	74	86·0	29	29·60	"	"	N.W.	Harvesting of wheat, linseed, arhar and other Rabi crops over Picking after harvest started.
21	98	76	87·0	28	29·62	Nil.	"	N.N.W.	
22	95	70	82·5	39	29·58	"	"	W.	Threshing of Rabi grains continued.
23	96	69	82·5	26	29·56	"	"	W.S.W	
24	99	73	86·0	40	29·54	"	"	Calm.	
25	100	74	87·0	35	29·48	"	"	N.W	
26	102	72	87·0	32	29·46	"	"	E.	
27	105	72	86·5	21	29·36	"	"	N.B.W.	
28	107	74	90·5	20	29·40	"	"	"	
29	108	78	94·0	17	29·42	"	"	W.N.W.	
30	108	78	94·0	20	29·42	"	"	W.N.W.	Harvesting of hill pototes over.

May, 1935

Date.	Max. Temp	Min. Temp	Mean Temp	Percentage of Humidity.	Atmospheric Pressure	Rain for the day.	Rain since Jan. 1	Wind direction.	Remarks.
1	109	72	90·5	22	29·40	Nil.	1·67	W.S.W.	Ploughing of Rabi fallows for next Kharif continued.
2	110	72	91·0	23	29·39	,,	,,	,,	
3	108	72	90·0	25	29·38	,,	,,	Calm	Picking of grain ears in harvested fields, bullocks threshing of certain grains of threshing floor.
4	108	73	90·5	16	29·36	,,	,,	E.S.E.	
5	109	73	91·0	25	29·39	,,	,,	E.	
6	109	74	91·5	23	29·43	,,	,,	W.S.W.	
7	110	80	95·0	22	29·38	,,	,,	,,	Manuring fallow lands with composted munure started.
8	109	80	94·5	20	29·37	,,	,,	,,	
9	108	82	95·0	26	29·41	,,	,,	W.E.	
10	108	82	90·0	41·0	29·44	,,	,,	W.S.W.	Sale of Bhusa and some potato, pumpkin, gourds, etc.
11	104	82	93·0	33·0	29·36	,,	,,	W.S.W.	
12	106	82	94·0	36·0	29·41	,,	,	W.S.E.	
13	105	83	94·0	38·0	29·46	Trace	,,	W.E.	
14	104	80	92·0	39·0	29·40	,,	,,	W.S.W.	
15	104	81	92·5	32·0	29·38	,,	,,	,,	Ploughing for and sowing maize after potato harvest.
16	108	80	94·0	28·0	29·32	,,	,,	,,	
17	118	84	97·0	26·0	29·26	,,	,,	,,	
18	111	85	98·0	20·0	29·32	,,	,,	,,	
19	108	86	97·5	27·0	29·33	,,	,,	,,	
20	110	86	98·0	22·0	29·26	,,	,,	W.E.	Harvesting of Napier grass and Bajri and cut into the silo pit during the month.
21	110	86	98·0	33·0	29·22	,,	,,	W.S.W.	
22	112	90	101·0	21·0	29·22	,,	,,	,,	
23	112	90	101·0	26·0	29·20	,,	,,	,,	
24	114	86	100·0	22·0	29·20	,,	,,	,,	Making baskets of stalks and rapes.
25	113	82	97·5	15·0	29·21	,,	,,	W.E.	
26	112	80	96·0	16·0	29·20	,,	,,	S.W.	
27	114	78	96·0	13·0	29·18	,,	,,	W.W.	Preparing of nursery beds for vegetables started.
28	114	82	98.0	16·0	29·14	,,	,,	S.W.	
29	115	88	101·5	15·0	29·20	,,	,,	W.S.W.	Levelling started again.
30	110	86	98·0	25·0	29·18	,,	,,	,,	
31	114	84	99·0	23·0	29·14	,,	,,	,,	

LOWLY TOAD WORTH ITS WEIGHT IN GOLD.

The common, lowly, worty toad is worth its weight in gold to any farmer, gardener, or florist, says Leonard Hasenman, chairman of the Department of Entomology of the Missouri College of Agriculture. Some growers even stock their gardens with toads.

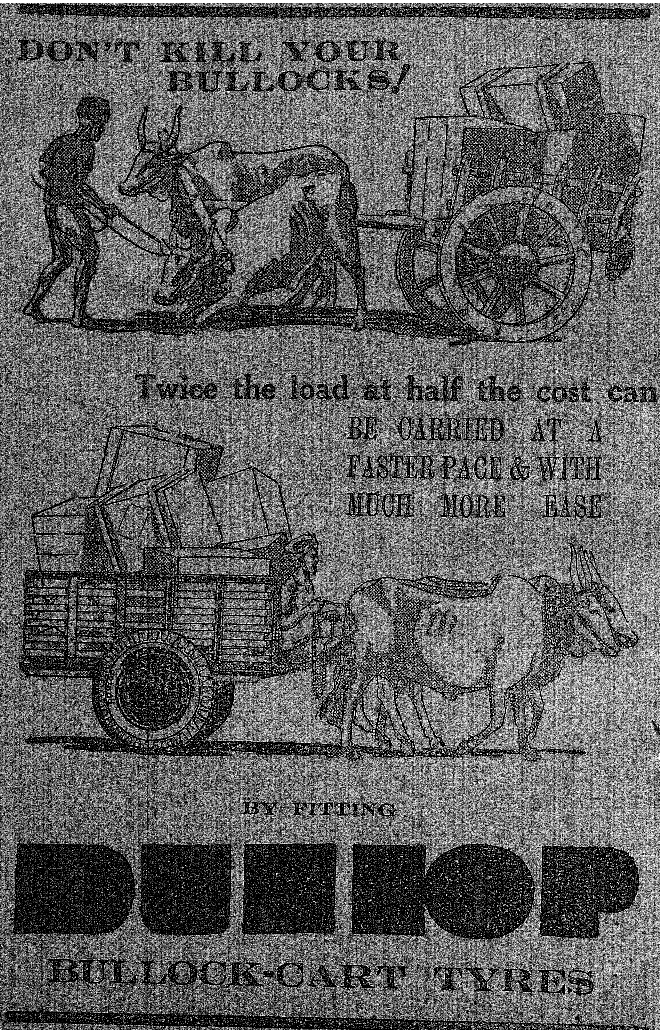
There are few animals so well adapted or so efficient in destroying the crawling, hopping, and low-flying insect pests as is the toad. No insect pest is too small or too large for the toad to tackle, and it has even been reported that large toads have been seen to eat small mice. If those who are so ready to kill the toad or who incorrectly look upon it as the producer of warts, only knew how many harmful insects toads destroy each summer, they would be more ready to protect this animated bug-trap.

No cat after a mouse was ever more clever than the toad in stalking its prey. Approaching the moving prey the toad suddenly freezes when within about two inches of it. With the toad's body slightly elevated and head down, the bug disappears so suddenly it cannot be followed with the eye. The toad's moist, sticky tongue, which is loose on the back end, is suddenly thrown forward, strikes its prey, and like a rubber band is so quickly drawn back into the mouth that it cannot be seen. No insect has a chance with such a trap.

Toads, the same as beneficial birds, soon recognize a favourable feeding place and may be seen feeding in the same garden or lawn night after night. Some persons even claim that the toad returns to these same haunts year after year. Snakes, and man with his carelessness and oftentimes wanton destruction, are the worst enemies of this great human benefactor. Farmers and gardeners in particular should realize the value of the toad as a destroyer of insect pests.

Most people are familiar with the fact that as the spring opens toads leave their hibernating places in the ground and go in search of ponds or pools of water. Then may be heard the spring toad chorus which announces the breeding season. The common tadpoles are the young of the toad, and ponds are often literally alive with them. As the tadpoles grow their swimming tails slowly disappear, their legs begin to sprout, lungs replace their gills, and the small hopping toads leave the water in search of summer feeding grounds where insects are most abundant.

— *University of Missouri Farm News Service.*


DON'T KILL YOUR BULLOCKS!
Twice the load at half the cost can
BE CARRIED AT A FASTER PACE & WITH MUCH MORE EASE
BY FITTING
DUNLOP
BULLOCK-CART TYRES

A. P. Brooks

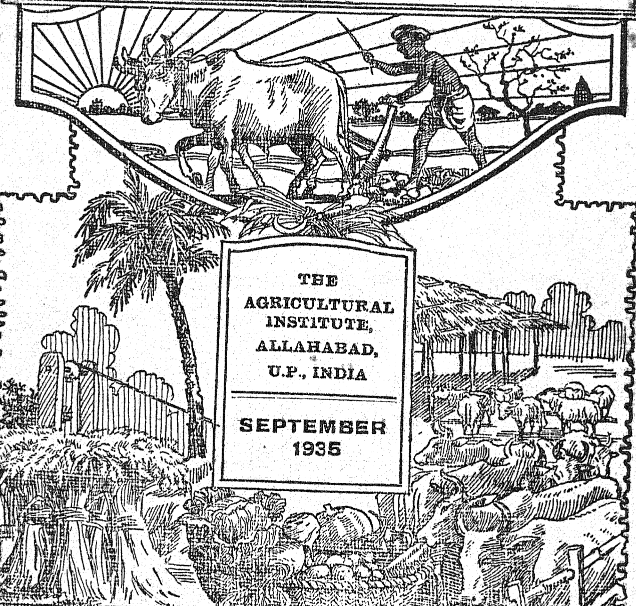
VOL. IX] [No. 5

THE ALLAHABAD FARMER

A bimonthly Journal

OF

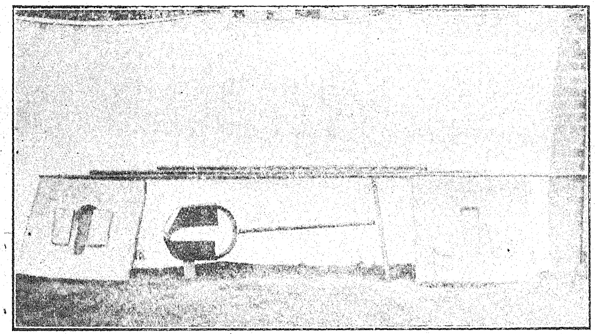
Agriculture and Rural Life



"The application of science to agriculture, industry and transport all over the world is the condition precedent to the realisation of universal democracy."

DR. BENI PRASAD.

The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

Balrampur (Oudh)
August 24, 1935.

Agricultural Engineer
Allahabad Agricultural Institute

Dear Sir,

...You are at liberty to publish any part of our letter as an advertisement in your paper. In fact, from what we have seen of the Wah-Wah plough, we are led to believe that the publication of the advertisement is more in the interest of the cultivators than it is of yours.

Thanking you again for the excellent service and advice,

Sincerely yours,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

AND THE LETTER REFERRED TO ABOVE:

Agricultural Engineer
Allahabad Agricultural Institute

Dear Sir,

We are very grateful for your letter of the 25th July last and for the plough. We had the plough weighed against a Meston plough, and found that yours was lighter by 3½ seers.

It will very well meet with our requirements. We also started using a........plough, and found that the share broke and the wooden handle of the plough also gave way under the strain. We have in fact found all your ploughs very useful and visitors to our farm have very much appreciated these, and we believe two parties also placed orders with you at our instance. We feel confident that the improved "Wah-Wah" bottom plough will very quickly displace the........type plough.

Yours sincerely,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

The Allahabad Farmer

A BIMONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

MANAGING COMMITTEE

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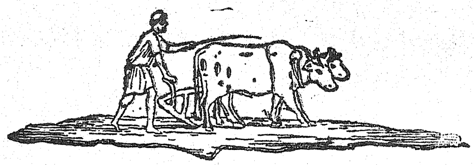

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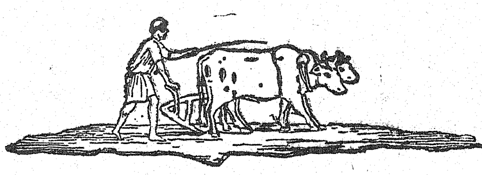


VOL. IX] SEPTEMBER, 1935 [No. 5

Editorial

His Excellency the Viceroy Visits the Institute.

The 24th of July, 1935, was a red letter day in the history of the Allahabad Agricultural Institute. In spite of the fact that we have just had a visit from His Excellency Sir Malcolm Hailey, just before he left India, and also a visit from Lord Irwin, when he was the Viceroy of India, this present visit of His Excellency Lord Willingdon, at this time when there is so much agitation for rural reconstruction and a spread of education on the country side, seems to us to put a stamp on the type of education that an institution of this kind is giving to India. His visit is therefore, we believe, an inspiration to all of us who are trying to help the Indian nation by helping the poor peasant of India.

* * * *

Sir J.P. Srivastava Visits the Institute.

As we go to the press we have been informed that the Minister of Education, Sir J. P. Srivastava, is also going to visit the Allahabad Agricultural Institute on the 19th August, 1935. This we hope is a sign that there is a general awakening and realization in the minds of the authorities and powers-that-be of the needs for the expansion of agricultural education in this country.

The B.S. (Ag.) Results.

It was very gratifying to learn that this year also, as well as last year, all the students who went up for the B.Sc. (Ag.) Examination of the Allahabad University have passed. The following were placed in the second division: A. D. Chand, A. H. Khan, A. T. Sanyal, B. C. Sen, P. Mukerji and T. B. Lal; and the following in the third division: A.K. Mitra, B.K. Dhar, B.K. Niyogi, B.S. Kocharekar, H.T. Banerji, M. C. Chacko, P. D. Upadhya, Pratap Singh, R. S. Varma, Saraswati Charan, Shanti Sharma, S. D. Bhagwat, and S. M. Ali.

* * * *

Osilanore Rural Uplift School.

One of the most encouraging news that has come to us lately is, that one ot these men who passed their B.Sc. (Ag.) this year has already started a rural uplift school. The young man, M. C. Chacko, left here early in May for his home in Travancore. By the end of May he had already started a rural uplift school with the help of the local gentry, and within a fortnight after the opening of the school, 99 students had already joined the institution. Among the subjects taught in this institution are Agriculture, Cattle breeding, Poultry farming, Bee-keeping, Handloom weaving, Co-operative Societies, Domestic Science, Sewing and Music. We offer Mr. M. C. Chacko our congratulations, and wish him all success in his new undertaking.

* * * *

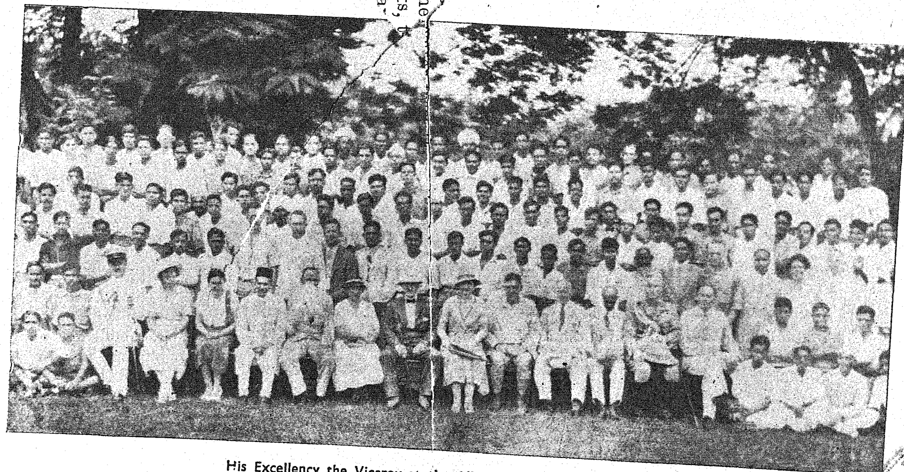
A Rural Life Conference.

A Rural Life Conference was held during the summer at Landour, Mussoorie, in which Dr. Sam Higginbottom, Principal of the Allahabad Agricultural Institute, presided. The meeting was attended mostly by missionaries who are engaged all over North India in agricultural missions. Among the papers read in that Conference were: (1) The Improvement in Village Diet, (2) Co-operative Societies, (3) Village Sanitation, (4) Village handicrafts, Etc. Amongst those who presented papers at the conference are Bishop Lapp from Dhamtari, Mrs. Wiser from Saharanpur, Mr. and Mrs. Vaugh from Allahabad, Mr. Buchanan from Indore, and several others.

* * * *

Aneed for Agricultural Propaganda.

The record of hybridising plants in India in order to produce improved varieties of crops for the farmer has been a very glorious one. And during the last few years so many other lines of agricultural research have been pursued that the results would be of immense value if made available to the farmer. We have learnt a great deal in the course of the last few years. But somehow this knowledge has not been of practical value to our Indian peasant. It seems



His Excellency the Viceroy at the Allahabad Agricultural Institute.

29th July 1935, Lord Irwin

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therefore very urgent that such knowledge, whichever has been proved to be of practical value, should be a common knowledge also of the farmer so that the benefits of agricultural research will not be confined to files but made immediately available to the farmer.

We would therefore urge not only the agricultural departments to make more use of the farm inspectors as farm advisers but to somehow keep them constantly in touch with the existing agricultural colleges and experiment stations in the country.

* * * *

Weeds on the Farm.

While a good deal of work has been done in India to help the farmer increase his profits from the farm by the introduction of improved varieties of crops, and while all those who are concerned with agriculture in India are devoting a great deal of energy to combat such enemies of the farmer as the insect pests and plant diseases which are due to either bacteria or fungi, yet practically nothing scientifically has been done in this country to help the farmer control one of his worst enemies, namely the weeds on the farm. It is difficult to estimate the damage caused by weeds, but undoubtedly they cost the farmers of India several hundred million rupees annually. For the weeds not only rob the food which otherwise would go to crops but they also harbour insect pests which later on spread to the crops and vegetables grown on the farm; they also harbour diseases, they remove the water from the soil which is so essential for the growth of plants, they smother the crop by shading it, and so on. All these things and many others are easily recognized by a farmer and he takes pain to remove as far as possible all the weeds on the farm. But the cost of weeding is tremendous. And unless a farmer finds more efficient means of controlling weeds, the heavy cost of weeding will still have to be borne by the farmer and ultimately by a consumer.

Some of the methods generally used at present in controlling weeds are by preventing weeds from maturing seeds, or by preventing perennial weeds from making top growth. In some countries certain laws have also been passed to prevent the introduction of weed seeds. Again, in some countries of the world where the weed problem is not as great as it is in this country—for weeds in this country seem to grow more profusely than they do in other countries of the world—still other methods have been tried out as, for instance, the control of weeds by herbicides. It would, we are sure, help the farmer greatly to know how to control such weeds as *motha* (Cyperus rotundus), *Bathua* (Chenopodium album), *Pathri* (Boerhavia diffusa) and a host of other plants which seem to grow everywhere on the farm. It is hoped therefore that this line of research will not be lost sight of in the course of the next few years.

THE VICEREGAL VISIT

SAM HIGGINBOTTOM.

Lord and Lady Willingdon honoured the Institute and Leper Asylum by a visit of one hour and twenty minutes on July 24, 1935. While the Viceroy was inspecting the farm departments, Her Excellency was taken through the Leper Asylum, and Children's Homes. My wife will tell about that on her page.

It has been my privilege during the last twenty-five years to take many distinguished visitors round the farm. I have never taken round a more gracious, and interested observer than His Excellency Lord Willingdon. He has the understanding heart. Because of his other engagements a programme had to be drawn up to show the most in the shortest possible time. Because of the season of the year, the Institute had to have one programme if it were raining, and another if it were not. Almost up to the moment of arrival it rained heavily. Then it cleared for about an hour and a half. As the Viceroy had come to see the Institute at work all staff and students were at their posts. The Director and Deputy Director of Public Instruction, the Vice-Chancellor of the Allahabad University, and the Dean of the Faculty of Science were the only invited guests. These guests were presented upon the arrival of Lord Willingdon. The dairy where butter and cheese-making, milk-testing and separating were going on, was first inspected. Then the dairy herd. His Excellency was greatly interested in this as years ago at Government House, Poona, he had established a herd of Scindi cattle. The pigs and poultry also held his attention, as did the silage made from Napier grass, which yields about one hundred tons of succulent fodder per acre per year. It was hard to get the Viceroy to move on: so interested was he in this section.

The horticultural department was next shown to him by Mr. Hayes. Students were at work grafting and budding. The variety orchard, the Florida grape fruit grove, the jams, jellies, chutnies, all interested him. The making of the latter he thought would be a fine activity for rural reconstruction workers to introduce into the centres.

Then the farm machinery. Here again I think His Excellency could have spent profitably all the time allotted to the whole programme. His questions to the engineer in charge were so well put, that he called forth the best the engineer had to give. Because it was so wet under foot we climbed to the roof of the machinery building, to see from afar the soil reclamation work, prevention of erosion and contour irrigation; all things of superlative economic and social importance to India. Then through the Hostel yard to the Laboratory where a class in economic entomology was at work.

Nothing seemed to escape His Excellency's eye. He observed and got the point. He thought our broadcasting installation a wonderful thing for village improvement work.

The farm dispensary for the farm workers and village folk, under the capable management of Dr. Hayes and staff, drew strong words of commendation from Lord Willingdon. Then to the bungalow. So well had the programmes been arranged that the Viceroy and Lady Willingdon arrived at the bungalow within a minute of each other. Here beautiful framed autographed photographs of their Excellencies were presented to the Institute. They will be placed in the Library, a constant reminder of this memorable visit. We are grateful for this memorable gift. Then a large group photograph, and off to keep other important engagements.

The Viceregal visit had entailed a lot of extra work on all the farm folk, farm labourers, students and staff. Was the visit worth it? What has been gained by it? Is there anything of permanent worth that will result? Yes: to all.

The day was very trying. After the rain stopped it was very muggy, steamy and hot. We were away from fans, we had to move fast. I noticed one gentleman's necktie completely soaked with perspiration. I do not remember a time when one could sweat more easily or profusely. It was no light undertaking for Lord and Lady Willingdon to come at such a time of the year. It was very trying and wearing physically. Where they, in view of all their great responsibilities and obligations, justified in visiting the Institute and Leper Asylum, especially at a time when it meant so much personal discomfort? I believe the visit, the toil, the discomfort are all amply justified, and all are well repaid. The official stamp of approval by the highest in the land is given to private effort put forth in behalf of rural India. It is the promise of a better day for village folk. They who have toiled so uncomplainingly throughout the generations, often for inadequate reward, who have been exploited, who have suffered social and economic neglect and injustice, are at long last to receive proper consideration, they are to be trained for a richer fuller life. Something of what they have paid in taxation is to be spent on them. Lord and Lady Willingdon have shown themselves sympathetic towards the great mass of the Indian population. With such champions, the rural workers and rural folk can go forward in confidence, and hope that their long, dark night is ended and a new and richer day dawns full of promise for all the under-privileged of Village India. Long may the Institute continue to serve India worthily, where her need is so great. It helps those in charge to know that their work has earned the good wishes of so capable a statesman as Lord Willingdon, Viceroy of India.

WELLS FOR IRRIGATION

By W. H. Hallister.

The increasing need in India for wells to irrigate gardens, orchards, and field is widely recognized. In some areas this ranks among the major problems for human welfare.

The initial cost of well construction, the uncertainty of finding an ample water supply, deters many from such an investment. When one has seen friends or neighbors sink several hundred rupees in a well that supplies but little water, prudence leads to suffering present ills rather than venturing on the uncertain and unknown.

Reduction of initial cost of wells is of prime importance. This is possible in three of the more expensive items: A. Excavation. B. Dealing with water during construction. C. Construction of walls. In order to economize it is essential to begin with a right start, right plans, right methods.

Right Start.—The *first step* should be—preparation of the garden or field, not excavation of the well. Ground should be ploughed, water channels outlined, plans perfected to use profitably every barrel of water raised during construction. Avoid the common mistake of spending 50-100-200 rupees lifting water to throw away. Use the water and when it becomes superabundant, lift it joyfully and profitably. Don't lay a foundation of walls prematurely as many have in the past. Remember this important fact—water level in many places gets lower in the course of years. Wells should be life and health preservers in times of drought and famine. Each foot additional depth may add many rupees to the value of the well.

Right Plans.—In some areas it is advisable to dig a very small trial pit to ascertain if rock will be encountered above or in the water level. If rock is found try another spot. Avoid bondage to antiquated methods. One seeking gold makes a shaft small, inexpensive to gold bearing rock. The same principles should be applied in making a well. The productive, the valuable part of the well, is that portion lying within water bearing strata. All else is but a means to reach this level and lifting water out of it.

A well should be an inverted T, a shaft leading down to tunnels branching in various directions to tap all possible veins of water and afford *storage space.* In some formations a large bowl may take the place of tunnels or the bowl may have tunnels added in course of time. If infiltration is slow the bowl or tunnels should be larger to store more water each night, especially if oil engines may be used. The bowl and tunnel method is ideal in vast regions in India where disintegrated granite, soft volcanic rock or sandstone prevail.

Right Methods involve several factors. For two reasons the small shaft should be circular: (1) The sides are less likely to scale off and endanger workmen. (2) A circular wall may be much thinner than a straight wall. This makes for large saving in excavation, in material for the wall, and labour.

When water becomes abundant renew courage and dig deeper. Remember what long drought does to wells. This is the hour of victory and years of reward or of defeat and long regrets. The water is not troubling you but rewarding you for lifting it. Enlarge your garden and lift water night and day.

When lifting both water and dirt (dirt is matter out of place) baffle your best effort and if it seems impossible to lay the foundation of walls deeper modify your plan. Instead of excavating the whole shaft make four holes (one at a time) as far apart as you can. If possible make the holes 6-8 ft. deep. Place in these holes cement blocks (or stone) 16 in. square. Put wire around each block and let it down with a hook on a stick. In this way you can rapidly make 4 pillars. On these pillars lay stone or cement slabs (or iron bars) and start building a wall. Excavate between the pillars and make tunnels for when you want to increase the water supply content, if that need not be done for many years, till prolonged drought makes it necessary. If the wall is not built on pillars be sure to construct it so at least two narrow openings may be made and tunnels dug at some future time to increase flow and afford large storage room.

In alluvial soils tunnels will require walls and roof. Where stone slabs are available they can be set perpendicularly, top leaning outward, on both sides. Make the roof also of slabs. Fill openings above slab to avoid their being broken by matter falling on them. Brick, stone and cement blocks may be used for side walls and reinforced cement slabs for the roof. Tunnels may be very narrow where roofing them is difficult. Construction of tunnels will not be expensive if all the water is used profitably.

In some areas in India the soil is of such a nature that scaling of walls is a serious problem during excavation. This scaling of the sides is much greater in a very large well as work proceeds more slowly. Scaling may be prevented by hanging wet mats or gunny bags in the well and covering the top, when work is not proceeding, to retain moisture.

In some areas the caisson method is popular and highly successful. As an improvement on the heavy wood ring for the base of the caisson some will prefer one of steel and concrete, made as follows: From 2″ angle bar make a ring for the cutting edge of the caisson. Before bending to a circle the desired size drill ¼ holes 8″ apart in both sides of the bar. This caisson ring should be in two sections for convenience in handling, bolt to the outer side

galvanized iron sheets about 15" wide. Insert 6" wire nails, heads down, in the holes at the top to bind iron and cement.

When excavation reaches the strata of earth where the caisson is needful—it must be above water level—lay the steel frame in a V shaped channel 15" deep. Fill this channel with concrete, re-inforced with wire or small steel rods. Allow the concrete to harden before laying the wall on it. This V shape facilitates excavating better than the plank ring. If the caisson is to be sunk in strata that permits of tunnelling, plan two doors for tunnels. Place iron bars in the concrete below the doors. Fill the doors with brick (to be removed when tunnels are to be made) and place iron bars over the doors.

In the vast areas where granite, limestone, basalt, and other hard rock must be drilled and blasted by this method, a small shaft affording access to a large bowl or tunnels will very greatly reduce the cost. Tunnels will afford storage space and can be made where the overhead rock is insecure for bowl shape. Because of wider spread they may tap very important veins of water.

In the large areas where the water bearing strata is disintegrated granite, in the volcanic rock of the Deccan and where sand rock abounds, this method is ideal.

I wish to lay special stress on the advantage gained by building the wall on deep laid pillars to make possible future deepening and enlargement by tunnels.

Methods of lifting water have vital relation to profitable irrigation. It is folly to pay the cost of a large shaft for a deep well, so a cumbersome leather bucket can be used. A small shaft suffices for a metal bucket guided by wires heavily weighted at the bottom or for pumps.

I am convinced that excellent but very cheap pumps can be devised by *united skilful effort* to meet the needs of India. Simplicity of construction, by small town artisans, easy replacement of worn parts locally made, and great capacity, are vital elements.

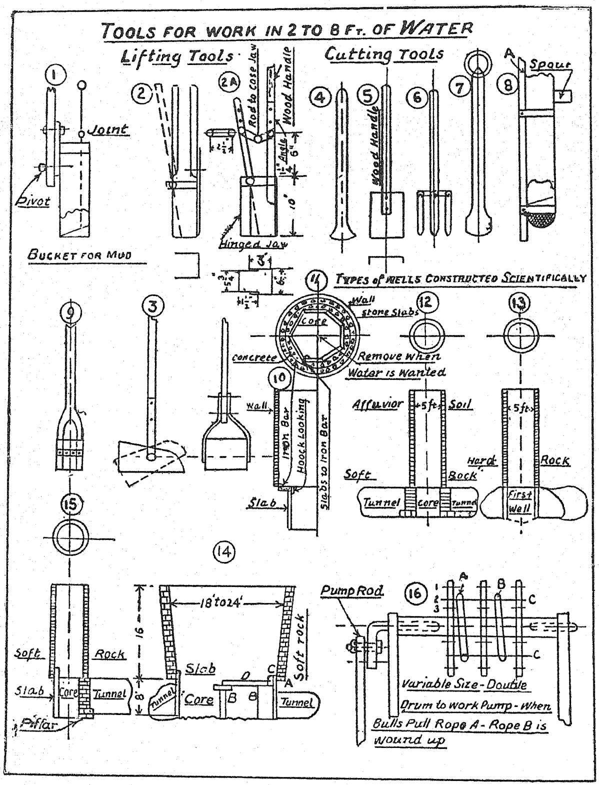
It is a simple matter to actuate a pump by one or more coolies walking back and forth on a pivoted platform.

Village artisans can easily make a variable size double drum to actuate large pumps by bullock power.

The key note in all well construction should be—DIG DEEPER; DIG STILL DEEPER, ENLARGE THE BOTTOM.

To make possible the additional depth that will make a well a silver-mine, to enable construction of pillars several feet below the level, walls can be laid and thus pave the way for future increase in depth. I have designed a simple set of tools easily made by small town artisans. These tools facilitate and make quite possible

(Continued on page 210).


TOOLS FOR WORK IN 2 TO 8 FT. OF WATER
Lifting Tools
Cutting Tools
Joint
Pivot
Bucket for Mud
Rod to close Jaw
Wood Handle
Angle
Hinged Jaw
Spout
TYPES of WELLS CONSTRUCTED SCIENTIFICALLY
Wall
Stone Slabs
Core
Concrete
Remove when Water is Wanted
Iron Bar
Hoock Looking
Slabs to Iron Bar
Slab
Alluvior
Soil
5 ft
Soft
Rock
Hard Rock
Tunnel
Core
First Well
18' to 24'
Soft rock
Pump Rod
Pillar
Variable Size - Double Drum to work Pump - When Bulls Pull Rope A - Rope B is wound up

A FEW HINTS FOR RURAL UPLIFT WORKERS

By Kunwar Narain Singh, Superintendent of Agriculture, Unao.

The development departments of the Government have been working for the betterment of the villagers. So far each department has been working separately on its own lines. Now they all have combined their forces to give an impetus with joint efforts to take out the rural population from the depth of ignorance, illiteracy and backwardness. It is an happy augury for the bright future of the country that social workers also have concentrated their energies on the problem of rural reconstruction and have taken up this important work under the guidance of Mahatma Ji—the mightiest dictator—who has given up everything for the uplift of the rural masses. Those who have studied or even have lived in the villages to see the condition will testify that the rural population is far behind the urban people in all spheres of life, social, physical, mental and economic. It is not a case of a local disease that can be cured by a bandage here or a liniment there, but it is that of general break-down requiring an all-round improvement. If the diagnosis is correct, the remedy is not far to seek. There is a simple prescription of four medicines which if properly administered is sure to give a radical cure:

Better cultivation;
Sanitation;
Co-operation; and
Education

are all that are needed for the amelioration of the poor condition of the rural population.

Right prescription is available but how it should be administered is equally important, as the sure and speedy recovery of a patient depends more on proper nursing than on mere medicines.

The improvement of the social mental and economic conditions of the rural population is the task before us.

Going into the detail of each of the above drawbacks we find that for social improvements we have to impress upon the villagers the value of thrift, so that they may not waste their money in ceremonies and litigation; the evils of intoxicants and early marriages which ruin their health, and the advantages of female education which will elevate the women; and the dire results of borrowing, for once a small loan is taken, the amount goes on increasing in spite of all his savings that he deposits with the money-lenders towards the payment of his debts.

For physical improvements we have to teach them the advantages of sanitation and hygiene, and raise the general standard of living and provide facilities for cleaning their wells, roads and surroundings, and arrange for maternity and child welfare and precautionary measures for simple diseases by giving medicine boxes for human as well as cattle diseases, and through vaccination and inoculation. We will also have to arrange for play-grounds and encourage games, organise clubs, reading rooms, dramatic performances, and impress upon them the necessity of maintaining a flower garden in the houses where space is available. Unless their sense of decency and cleanliness is awakened, it is futile to expect much progress in making their villages cleaner and healthier than they are today.

Many ailments can be cured by simple precautions which cost nothing but require a knowledge of sanitation. Nature is the best physician and the cheapest remedy under hygienic conditions; for instance many diseases are caused by dirty water in the village tank and many wounds get worse simply because they are dressed with the dirtiest cloth. If the illiterate villagers are made to understand the value of boiling water as a curative agent for many diseases and the necessity of keeping a wound washed by "nim" water and dressed by a clean cloth, much of their miseries will be avoided. Again constipation is the root cause of many ailments which can be avoided as well as cured by fasting or taking milk, fruits, or fresh vegetables instead of half-raw, half-burnt thick bread of "bijhra". It costs nothing but information.

Mental improvements can be effected by education, which should be more technical pertaining to their profession agriculture, rather than literary. If practical training in improved methods of cultivation is given to every student on the demonstration plots attached to the rural schools, where most of the students are the sons of the cultivators, and elementary knowledge of scientific agriculture is so carefully imparted as to fit in with the poverty of the cultivators and their petty holdings, it will not only keep them in touch with their hereditary profession but will teach them the efficiency of improved seeds and implements and will kill the prejudice that any kind of manual labour is below the dignity of a person who has received some education, however elementary it may be.

One thing that both study and observation bring forcibly to the mind, is the general poverty of the villagers; poverty in information as to how their condition could be improved and poverty in material resources to secure those things which could make their occupation progressive. It is the root cause of all the troubles and miseries and the greatest obstacle in the way of improvement. Any step that is taken to bring them more money will not only be most welcome but will win their confidence. Once their confi-

dence is won you can teach them how to spend their money, how to clean their houses and villages and make them healthy and comfortable, how to avoid ill-health and epidemics, how to bring up their children in health and cleanliness, how to educate them and how to lead a happy life.

It is well remarked that the well-being of a nation is like a tree, agriculture is its root and commerce its branches. If the root is injured the leaves fall, the branches break away, and the tree dies. The prosperity of the country therefore depends upon the improvement of its agriculture. Unfortunately the land in India is unfenced, undrained, unembanked, unwatered, unmanured, carelessly ploughed up, and pure seed is rarely used. The results are obvious and require no mentioning. Its efficiency is lost. Agriculture can be made efficient, *i.e.* cost of production can be reduced and margin of profit increased by the adoption of the improved methods of cultivation. The rural workers should, therefore, primarily look to :—

(*a*) Better farming.

(*b*) Proper marketing of the produce.

(*c*) Cottage industry for the leisure hours.

Better Farming

Our soil is capable of producing nearly double the present yield if improved methods of cultivation are adopted, and the quality of the produce can be greatly increased by the wise selection of the seeds. What comes in the way of improvement is the tardiness with which the obvious and profitable means of increasing the outturn are adopted by the cultivators. It may partly be due to the petty holdings, poverty, indebtedness and insecurity in the possession of land, but want of confidence is mostly responsible which does not let him take advantage of the various suggestions made. Use of improved implements economises labour and time. Improved seeds give greater yield of better quality which fetch higher prices in the market. Efficient methods of making and preserving manures and proper rotation of crops maintain the soil fertility. Improvements in water lifts, live-stock, and in fact in everything that a cultivator needs, have been made. All that is needed is to make them adopt those improvements.

Marketing

Another item which is of equally great importance is the marketing arrangement of his produce. The only capital with a cultivator is his standing crop. As soon as it is harvested it goes to pay up his debts and dues. Every cultivator does not possess a cart, nor can he manage to remain away from home during the

threshing period. He is also afraid of being robbed on his way back from the market. The pressing demand of the zamindars and the money-lenders compels him to part with his produce from the threshing floors at any rate that is locally available. Generally his debts are paid in kind, in which case he has to give about 10 to 15 per cent. more than the local rate. If any cultivator has sown an improved seed he does not get a better price for his superior quality because the quantity, being a small one, has to be mixed up with the local variety, hence the purchaser does not pay a higher price for it. This practice is an obstacle in the introduction of the improved seeds. Since every cultivator is dependent upon the money-lender and a long chain of middle men between himself and the consumers he has to submit to unduly low prices for his produce. Co-operative marketing societies will offer the best chance to the cultivator for realizing the full price for his produce. These societies will purchase all the produce, stock it according to the variety and quality, and will arrange for its sale directly with the big dealers, and thus make an additional profit which would otherwise go to the middle men. The work of these societies can be done equally efficiently, rather better, by the local bodies of a few energetic men, who after studying the important crops of the locality should try to increase the yield both in quantity and in quality, should purchase such stock and deal directly with the big merchants, should secure orders from the store purchase department and superintendents of jails and boarding houses, to get the best value of the produce. They should also seek help from the railway authorities, for concession rates and from the district boards, for improving the means of communications and drainage of water which isolates a large number of villages during the rains. They should approach municipalities for the reduction of octroi duty on agricultural produce and should try to standardize weights and measures and market dues, like Karda, Dhalta, Dallali, Bayai, Gaushala, Thakurdwara etc., which are different, in different markets. Such societies will be a great boon to the cultivators and with their efforts both the producer and the consumer will be benefitted, inasmuch as the middle men's charges will be eliminated and the introduction of the improved seeds will develop enormously as seed of superior quality purchased from different cultivators and brought to the market in large quantities at a time when the rates are favourable is sure to fetch a good price much above the market rate.

Cottage Industry

Agriculture is not a profession that can keep an average cultivator engaged in his field every day throughout the year. On account of the seasonal nature of agricultural operations idleness

is forced upon him from 150 to 200 days in a year. The introduction of a suitable cottage industry will help him out of his pecuniary difficulties. Rural workers should find out which of the following cottage industries can conveniently and profitably be taken up by the villagers—rope making, toy making, soap making, sewing, spinning, weaving, knitting, basket making, bee-keeping, dairy, poultry, fruit and vegetable growing, leather working, sericulture, lac culture, hosiery, tanning, bamboo work, pottery, woodwork etc. and every cultivator should be induced to take up any of them. It will be a second string to his bow and will not only keep him and his family profitably engaged in their leisure hours, but it will be a recreation and a source of income sufficient to meet his daily expenses. He should also realise that unlike industry agriculture is a profession in which success cannot be guaranteed even by the best agriculturist. It is in fact gambling with nature. A cultivator has only to do what nature prompts him, to work in his field. Even by doing all the field operations at the right time and in proper manner according to the dictations of Nature he cannot be sure of his success as an attack of frost or hail-storm may damage it completely within a few hours, and his whole labour is wasted by agencies over which he has no control. To safeguard oneself against such calamities it is therefore all the more necessary to have another source of income, which in his case is cottage industry.

To persuade a cultivator to agree to part with his old customs and practices is to revolutionaise the man bent double with the weight of his prejudice and age-long conceptions. His ignorance, illiteracy and conservatism fill him with all sorts of apprehensions. To be successful with him is not a walk on the metalled road. The workers will have to make their way through a thicket full of thorny bushes which will have to be removed by hard struggle, patience, and tact. Again his poverty and inborn fatalism are the obstacles that cannot be overcome by a few months object lessons. It is not merely the introduction of demonstration of the improvements, but the main object is to help the cultivators to improve their own lot.

To be successful in rural uplift the worker should, therefore, bear in mind that :—

1. He should not only be familiar with those whom he has to serve but should gain their confidence.

2. He should study their needs and difficulties and find out remedies.

3. A thorough knowledge of the local conditions is essential before any suggestion for their improvement can be made.

4. He should not impose reforms on the cultivators but should work them from within.

5. He should secure the help of the local zamindar and should try to work in co-operation with him as his influence will ensure speedy success.

6. He should not go to any village as an officer but should meet the people as their friend, rejoice in their rejoicings and sympathise in their sorrow. They will then be intimate with him. Unless a feeling of love and friendliness is created instead of a feeling of awe with which an officer is invaribly looked upon by a villager, nothing can be achieved.

7. All the recommendations should be tried ones, suited to the locality, and within the means of the cultivators.

8. A cultivator is not so conservative as he is said to be, but surely he is too poor to take any risks; actual demonstrations with substantial financial gain either in increased yield or in decreased expenses are the best methods of convincing him of the advantages of what you recommend. Once he is convinced of the efficiency of your recommendations he will not only readily adopt them but will make propaganda amongst his fellow-workers better than yourselves.

9. Guide the cultivators intelligently. Try to extend their mental horizon and make them conscious of their own potentialities.

10. Whatever demonstrations you have in hand you should do thoroughly and successfully. It is better not to do at all than do them in a way which does not appeal to the cultivators.

11. You should concentrate your work in the centre of a big tract. It will afford better facilities for supervision and subsequently it will form a nucleus for development in the neighbouring villages without your efforts.

12. A marvellous change is brought about by scientific researches in every art and profession, and agriculture is not an exception to it. Most of the improvements in other things have been readily accepted and adopted, but unfortunately the improvements in the premier industry of the country which have been demonstrated to be efficient and economical, have not become popular, hence the rural population has the greatest share of poverty which brings disease, misery, suffering and unhappiness to them. The ambition of every cultivator is to sow every acre in every season but he has neither the cattle to plough nor manure to enrich the soil nor money to do the necessary operations. You should make the culivators understand that better farming is more profitable than big farming. A small area properly ploughed, heavily manured and sown with improved seeds is far better and more productive than carelessly cultivating a far larger area than can be properly managed. The salvation of our farmers lies in the adoption of the intensive methods of farming.

13. The villagers should be made to understand that they are not happy because of their old methods of farming, their being victims to diseases owing to insanitary and filthy dwellings, their illiteracy and want of knowledge of the scientific improvements in the art of cultivation, and because their children are unhealthy and they waste much of their money in litigation and bad social rituals and keep their women folk in degradation and slavery and pay no attention to bettering themselves and their surroundings. Understanding is aspiring and willing and where there is a will there is a way. Rural workers should see that villagers put forth arguments and discussions. If they maintain a stony silence the lecturer can cut no ice, but once they are drawn into an argument or made to laugh at their follies the battle is won.

14. Impress upon the villagers the value of co-operation which is the cement in the building of development and holds everything together and makes it doubly effective. Much litigation can be avoided if the spirit of co-operation prevails and substantial all-round improvement can be effected by joint efforts.

15. You are the makers and moulders of the village life. Your responsibilities are great, as the amelioration of the poor condition of the rural population depends upon your efforts, and in the proper discharge of your duties are interwoven the prospects of teeming millions of ill-clad, ill-fed, ill-housed and ill-brought-up people who although engaged from early morning till late in the evening in their fields, can hardly eke out their bare existence to keep their body and soul together. Your work is of a very high national order. You should therefore equip yourself with the necessary knowledge, sense of duty, sincerity, zeal and co-operation and with united efforts demonstrate to the public and to the Government that it is the real enthusiasm for work's sake and genuine desire to serve the country and Crown, that spur you on to the path of duty.

Unless you work with a missionary spirit, utmost care and thoroughness with a right conception of what you want to demonstrate patiently, persistently, under close and personal supervision, explaining to them the benefits and advantages of what you recommend and convincing them of the efficiency of the methods you demonstrate, the rural uplift is bound to be grievously delayed. You have to so educate the villagers that their whole outlook on life is affected and they develop an impluse for self-improvement—economic, social and mental and physical. The villager's extraordinary apathy towards any improvement must be fought and conquered by giving him a new outlook on life. You must convince the people of their capacity of achieving more than what they have so far achieved, and create among them the desire for better living which will make them pay heed to new ideas and new

methods of increasing wealth. I hold a firm opinion that a lot of good can be done to the villagers if you, after studying their needs and difficulties, find out remedies and convince them of the efficiency of your recommendations.

If you will work on the above lines they will love you, will think you as their sincere friend and true guide. When you serve them disinterestedly they will follow you blindly, and your suggestions will be gratefully accepted and immediately adopted.

(Continued from page 202.)

deepening a very large percentage of old wells, at moderate cost; many wells cannot be deepened without such special tools.

These include tools for cutting or drilling, for lifting cuttings from holes or channels partly filled with water; a bucket for semi-liquid matter and a very light pump to lift water from holes or channels.

Blue print drawings of these tools and drawings illustrating methods of constructing new and deepening old wells can be obtained at trifling cost. Anyone able to read drawings can direct village artisans in making these tools. They can also afford invaluable guidance in these methods of well construction and deepening of old wells.

I hope industrial schools, district and village boards, and others will make these tools to sell, and to rent to those who cannot buy.

If by united effort we can secure the construction of scores of better and cheaper new wells and the deepening of a few hundred old wells, we will pave the way for benefit to many who will learn by seeing these wells and will be inspired to do likewise.

"Poultry specialists find that a spray containing chlorine gas in an effective method of fighting bronchitis, colds and others respiratory diseases in poultry".—*Science News Letter.*

Strawberries which are 90 per cent. water are valuable as food chiefly because of the iron and vitamin C. they contain.—*Science News Letter.*

INDIAN FARMING PROBLEMS

Need of Literate Men Behind the Plough

S. C. Chowdhury

"Ignorance is the curse of God,
Knowledge the wing wherewith to fly to Heaven."
—*W. Shakespeare.*

I

The Importance of Agriculture.

India is an agricultural country. Three out of every four persons are devoted to agriculture. Agriculture is the one industry by which we live and upon which we rely for all our means of economic progress in other directions. It is the one source from which the nation gets its food supply, the state a large share of its revenue, and the trader the bulk of his exports. Agriculture is the back-bone of our entire economic life and as far as one can foresee it must ever remain so. Considering her peculiar circumstances, India can never be so thoroughly "industrialised" as to make agriculture of secondary importance. The masses have through the centuries been "rural" in their out-look. India's culture, social order, and economic life are all centred in the village. It is not possible and perhaps not desirable to effect a country-wide change in this out-look. In view of the ever-increasing tariff-walls that are being raised by other countries, excessive industrialising (which can rest only on free and extensive international trade) is no longer a safe course. India with her varied natural resources and teeming millions can be more or less self-sufficient economically. If the peasantry, who form three-fourths of the population, be prosperous, they will not only supply raw materials for India's industrial centres but will also be a readily available market for the articles manufactured in those centres. Nothing hurts India's internal and external trade so much as a failure of crops. Nothing is more essential for the prosperity of artisans and manufacturers than that there should be good harvests and enough purchasing power in the hands of farmers. If agriculture be unremunerative, the landlord, the mahajan, the trader, the manufacturer, and the artisan must all suffer along with the peasant. Schemes of unemployment redress which do not recognise this fact are bound to fail. In this country the peasant is the pivot of the entire economic system, and any scheme of development to be successful must keep the improvement of agriculture in the fore-front.

The Poor State of Agriculture.

But though agriculture is of such paramount importance in our life, it is even now in an extremely backward condition. It is not carried on scientific lines, and is far less productive than it should be. The reason for such a state of affairs is not far to seek. Though agriculture is not the first and noblest art, yet the old notion that agriculture is a dignified calling still obtains credence in India and "we see the plough driven, the clod broken, the maize spread, the seed scattered, the harvest reaped by men of the lower strata of the society."

The Human factor in Agriculture.

It is no exaggeration to say that efficient agriculture depends more on the quality of the man behind the plough than on anything else. "A study of rural condition in different countries leads to the conclusion that more depends upon the human factor than is commonly supposed. Defects in character can and will nullify the richest gifts of nature while what appear to be insuperable difficulties, are apt to disappear before the sustained application of human energy, human intelligence, and human knowledge. "It is clear, therefore, that unless the worker improves, his work never can or will prosper. Any improvement in the condition of our agricultural industry can only be looked for and the economic future of the country assured, if the farmer improves in his character and habits, in his intelligence and knowledge, and in his methods of work. A comprehensive scheme of rural education intended to improve the efficiency of the peasant, to change his psychology and social and personal habits, is not therefore a mere educational desideratum but an imperative economic necessity and an indispensable step towards agricultural improvement.

Agriculture not a primitive art.

Agriculture which was considered to be a rude, rustic simple mechanism of inverting the soil a century ago is not to be considered so to-day. All over Europe, America and Australia agriculture has taken up a new shape under the magic wand of science. The old subsistence type of farming intended to meet the demands of a family, or at least of a community, has very largely passed out of existence in the progressive countries. All over the West where agriculture engages comparatively a smaller percentage of the population (except Russia and Poland) than in India, agriculture is now considered to be "a science, a craft and a business" of a highly complex and difficult nature, demanding for its successful prosecution a thorough and sound knowledge of several other sciences:—Physics, Chemistry, Botany, Zoology, Bacteriology, Geology, Climatology, Entomology, Pathology, Engineering, Genetics, Veterinary, Survey, Soil Management, Economics, etc., etc. Agriculture is considered to be a scientific occupation and dignified calling and it is deemed

essential "that the farmer, like the surgeon and the engineer, should receive a proper instruction in his work—in the science of agriculture, in the craft of agriculture, and in the business of agriculture."

The need for Agricultural Education.

Agricultural education is an essential necessity for the improvement of our agriculture and for the betterment of our peasantry It is no exaggeration to say that so long as ignorance and illiteracy prevail in our villages and barely six per cent. of the population can read and write, all talk about rural progress is futile. No-one can deny the fact that the absence of wide-spread literacy and a suitable system of agricultural education are largely responsible for many of the ills and evils we deplore. "Agricultural instruction indeed enables the cultivator to understand the scope of scientific discoveries and the means of applying that. It enables him to calculate his operations to shield himself from frauds to which he may be exposed. It gives him the certainty after he has become acquainted with the elements of the soil he tills of using chemical fertilisers, the implements and processes which shall result in increasing his production. It will diminish the cost thereof and enable him effectually to compete with foreign rivals. By its means he will be able to draw with certainty upon the sources of credit which are open to him, to inspire confidence to lenders and give confidence to his landlord as regards the use he may make of the property under his charge. In this century of extreme competition the agriculturist can only thrive if in working the soil he adopts scientific methods. There is no profession more based on science or more dependent on scientific knowledge than agriculture.

And for primary Education too.

Clear is then the need of a system of agricultural education for the rescue of the Indian peasant. "Illiteracy aggravates indebtedness, promotes improvidence and extravagance, impedes the progress of agriculture, and what is more serious than anything else, prevents that mass awakening without which no reform can be permanent." "When a population is uneducated it is not progressive but stagnant. Its standard of living is low and has no tendency to rise. Any increase in their income tends to increase their number, and not to raise their standard of living or comfort." In order to rescue a long struggling and long suffering peasantry from the present degradation there must be widespread education in the country which will transform it into an industrious and enterprising peasantry. Widespread primary education with a bias for agriculture is a *sine qua non* for the rescue of our agriculture from absolute stagnation and the peasants from eternal damnation.

II

"No problem can be solved till education filters down to the masses who are the backbone—the mainstay of the masses."

—*S. C. Mitter.*

If then, the necessity of providing agricultural education in India be recognised, the next question is—how to impart it? It is our aim to answer this question, in brief, in this paper. But before we actually attempt to draw a scheme let us have a look at first into the present system of education in India.

Luck of Primary Education.

The first thing that strikes one in India is the utter inadequacy of the existing provision for primary education. And nobody can deny the fact that many of the ills and evils of our agriculture have one single root—the general lack of primary education. The average primary school in India has only 41 pupils, the number ranging from 28 in Behar to 62 in Bombay. The villages have smaller numbers than the towns. There is a boy's primary school for every 7·9 sq. miles in British India or one school for every 913 of the male population. There is a girls' primary school for every 47·7 sq. miles or one for every 5,250 women and girls. Thus we see that there is a great wastage of man-power in India! The fact is that the cultivators are illiterate and their children are growing up in ignorance, the exception being so rare and isolated as to be of no account for agricultural purposes. Now, if there is one principle on which modern statesmen in all countries are agreed, it is that popular education is the only means by which the condition of the masses can be permanently raised, and this truth has a special application to India where these illiterate labourers are left to accomplish without superior guidance the great economic task of the country. This is a grave ssate of affairs and no stone should be left unturned to alter it. A large and substantial increase in the number of primary schools in all the provinces is urgently called for as a necessary foundation without which any comprehensive scheme of agricultural education for the masses is a practical impossibility.

Mis-education.

This is one aspect of our education, namely its inadequacy. But it has another aspect too—its inefficiency. The system of education prevalent in this country has failed to fulfil its function as an instrument of "progress and prosperity." It hinders the growth of manhood in some respects. A farmer often finds that his son on learning the three R's. begins to despise manual work on the farm. This is nothing strange. How can a village boy respect the life of a farmer when the community in which he lives regards the farmer's occupation as unworthy? How can he be attracted to agriculture when he finds that in the school

he attends there is not a word taught concerning crops or cattle, and a clerical job is regarded as more important and nobler than farming? The same is true of the methods and ideals imparted in high-schools and colleges. We do not find agriculture taught even as an optional subject in the secondary schools and universities. The latter have up till now attached more importance to Law than to agriculture and have indirectly helped to aggravate the misery of the peasant by turning out large numbers of law-graduates who maintain their parasitic existence by actively promoting the habit of litigation amongst the peasantry. The Government have indeed established a few agricultural colleges; but their number is too few and they stand in isolation away from the main stream of higher education.

The present system of education needs to be remodelled. The existing educational institutions of the country, especially the universities, should remember that the ultimate goal of education is not merely the development of the individual as such but as a member of society. Education must directly and indirectly promote social efficiency and national prosperity. "National prosperity depends on the skill of the people, its varied development and not on the super-literary education of a minority. And any education which does not go deep enough to improve man's chances of making a living to the good of his country is of no use. A highly educated class for whose labour there is no demand, can only be parasitic on the country which educates it." When will our educational institute authorities recognise this?

III

"National life is an organic whole. It is neither possible, nor desirable to develop one limb at the expense of another. A nation cannot develop politically and economically without developing educationally and socially. Development must be all round.. The magnitude of the problem may frighten many but it is foolish to overlook facts. We cannot overcome a difficulty simply the shutting our eyes against it. If the task is big our efforts should be bigger still."

K. C. Chowdhury.

Now we venture to suggest a scheme—brief and practical for agricultural education. The points for consideration, among others, are these:—

(1) What sort of agricultural instruction is best for India?

(2) For what classes of people is such instruction desired?

(3) The teaching machinery and the curricula of studies.

(4) The management and control.

(5) The question of funds.

Before dilating upon the above points we must say that the entire system of agricultural education must rest on the solid foundation of a wide-spread primary education. Primary education, we suggest, should be compulsory for both the sexes up to the age of 14, and should be imparted through a large number of "Village Schools," as in Denmark. There should be one "Village School" in each village. The instruction imparted should be such that it will promote interest in and love for agriculture and rural-life in general. We propose that the subjects for study in these "Village Schools" should be—Vernacular, Arithmetic, Geography, History, Botany (Elementary), Practical Agriculture, Cattle-management, Religion, Music and Gymnastics. Boys and girls should be required to spend only a few hours within the class-rooms. They should be encouraged to work at home and in the fields along with their parents. It is necessary that they should grow up to be hardy and in direct contact with nature. It is not necessary for village schools to possess any demonstration farm. The boys should be taught and encouraged to apply their knowledge in their own farms.

The kind of special agricultural instructions.—On this point we should at once say that we want and desire a well-graded system of agricultural education which will be complete in all its branches. The whole system should be a combination of practice with science as in France and not a divorce of the two. For "Agriculture cannot be taught entirely by attending lectures delivered from the professional chair."

Classes for which agricultural instruction is desired.

Agricultural instruction is desired for the following classes of people :—

(1) The big landlords, *viz.* the Taluqdars, the Zemindars.

(2) The capitalist farmers.

(3) Small tenant farmers and other farmers.

(4) The landless labourers who wish to become farmers or to serve as efficient labourers on large estates and farms.

(5) Graduates of universities who wish to carry out advanced researches in the sciences underlying agriculture, to serve as teachers in agricultural institutions, as officers in the Government Departments of Agriculture, as Directors of Government Experiment Stations, as Directors of Sugar Mills, as Agricultural Engineers, or as Managers of Agricultural Farms.

I. Provincial Agricultural College.

The Teaching Machinery and Curricula.

A Provincial Agricultural College should be located at a suitable place in each province. This institution should be intended to impart the highest type of instruction in scientific agriculture and should be mainly for the science graduates of the universities wishing to qualify themselves for higher appointments in Agricultural, Revenue, Survey and Forest Departments, or wishing to carry on research work on these lines. The course of study should be for three years and a thorough training both in the science and practice of agriculture should be given. The subjects for study should be :—

LECTURES.

(1) Physics and Metereology.
(2) Chemistry.
(3) Agricultural Chemistry.
(4) Botany.
(5) Agricultural Botany.
(6) Zoology.
(7) Entomology.
(8) Plant Pathology.
(9) Bacteriology.
(10) Soil and its Management.
(11) Agricultural Engineering.
(12) Surveying and Levelling.
(13) Animal Husbandry and Dairying.
(14) Feeds and Feeding.
(15) Anatomy and Physiology.
(16) Diseases of Cattle and their treatment.
(17) Animal Breeding.
(18) Economics and Sociology.
(19) Estate Management.
(20) Co-operation.
(21) Book-keeping.
(22) Business Geography.
(23) Plant Breeding.
(24) History of Agriculture and Dairying.

PRACTICAL.

(1) Chemistry.
(2) Agricultural Chemistry.
(3) Physics.
(4) Botany.
(5) Plant Pathology.
(6) Bacteriology.
(7) Surveying and Levelling.
(8) Building Construction.
(9) Implements and Machinery.
(10) Ploughing, Harrowing, Weeding etc.
(11) Diseases of Livestock.
(12) Manufacture of Dairy Products.
(13) Judging of Livestock.
(14) Management of Livestock.
(15) Growing of Field-crops, vegetable, fruits and flowers—their harvesting.
(16) Preservation of vegetables, fruits and other farm products.
(17) Marketing of Farm Produce.
(18) Plant Breeding.
(19) Reclamation of Land.
(20) Irrigation and Drainage.

II. Divisional Schools of Agriculture.

There should be one Divisional School of Agriculture in each District. These schools should be intended for the sons of landlords who intend to open "Model Farms" themselves for the benefit of their tenants or want to manage their estates efficiently. These schools are also intended for the sons of the capitalist farmers. The least qualification for admission should be a school-leaving certificate. The school should own a large and a thorough knowledge of the science, and practice of Agriculture should be imparted to the students. The course of study should extend for two years and the following subjects taught :—

LECTURES.

(1) Physics and Metereology.
(2) Chemistry.
(3) Botany.

(4) Soil.
(5) Plant Pathology.
(6) Entomology.
(7) Bacteriology.
(8) Economics.
(9) Estate Management.
(10) Book-keeping.
(11) History of Agriculture and Dairying.
(12) Co-operation.
(13) Cattle Management.
(14) Anatomy and Physiology.
(15) Feeds and feeding.
(16) Disease of Livestock and their treatment.
(17) Dairying.

PRACTICAL.

(1) Ploughing, Harrowing, Weeding etc.
(2) Growing of crops, vegetables, fruits and flowers.
(3) Building construction.
(4) Surveying.
(5) Farm Machinery and Implements.
(6) Weeds and their control.
(7) Cattle management.
(8) Preparation and spraying of Fungicides and Insecticides.
(9) Preservation of fruits and vegetables.
(10) Marketing of farm produce.

III. Practical School of Agriculture

These schools are intended for the actual tillers of the soil and the landless labourers who wish to become farmers. There should be at least one such school in the jurisdiction of each Police station. The course of study in such schools should extend for two years and the aim should be to give a thorough practical training with some theoretical knowledge of the following subjects. The instruction should be given through the medium of vernacular :—

(1) Tillage and implements.
(2) Seed and seed testing.
(3) Control of Weeds, Insects and Plant Diseases.
(4) Feeding of the Cattle and their management.

(5) Common ailments of cattle and their treatment.
(6) Co-operation.
(7) Marketing of farm produce.
(8) Manure—Application and Preservation.
(9) Farm sanitation, water supply, and sewage disposal.
(10) Dairying.
(11) Cottage industries.

IV.—Short Courses in Agriculture.

Besides the institutions mentioned above there should be a large number of institutions distributed throughout the country for the purposes of giving instruction in cheese making, butter-making, wool curing, fruit growing, vegetable growing, flower gardening, ghee making, fruit preserving, poultry keeping, goat and sheep bearing, etc. The courses in such institutions should be from one to two months and there should be two sessions in a year.

V.—Agricultural Lectures.

The whole system of agricultural education should be supplemented by the appointment of Travelling Departmental Lecturers of Agriculture. They should teach in the "short courses' school" which will be working for four months in a year and spend the remaining eight months of the year by delivering lectures on practical agriculture in the districts, among the different communities of the farmers, the school teachers and the school boys. As to their duties, we have nothing to say at length, in particular, but to cite the instructions of M. Tirard, the French Minister of Agriculture to the Travelling Agricultural Lectures of France.

"Your mission is to keep the cultivators informed respecting modern discoveries and new inventions of economical and advantageous application, so as to let them be ignorant of nothing which it is to their advantage to know but to lead them forward in the general movement of progress they participate to so small an extent owing to their isolation. You will have to instruct them as to what reforms they may introduce in the processes of cultivation, in the selection and feeding animals. You will also call their attention to the preparation of manures, their utilisations, the way in which to increase their quantity by making use of fertilizers which are too often lost in the country-districts. You will show to them the advantages which arise from a good choice of seeds and of the varieties of plants cultivated and more particulary how to extirpate weeds which take the place of useful plants, how to

combat parasites of all kinds which ravage the crops etc., etc. And you will develop in them the love of progress and that spirit of initiative which causes them not to expect all from circumstances or in due time, but from their own efforts. You take care to cite as example the results obtained by enlightened cultivators who employ good method. And you should in short exert yourself to describe in each locality what agriculture ought to be, and after examination, you should indicate what should be done. In addressing cultivators and practical men who have the knowledge for themselves which tradition gives—that is to say, the slow and patient observations of facts from generation to generation—you should dwell only upon well known truths and principles clearly proved by science.

Management and Control.—All the institutions we have proposed should be under the administrative control of the Director of Public Instruction of the province. In all professional matters relating to studies, teachers text books, tests etc., the Department of Agriculture should supervise.

The staff of the Provincial Agricultural College should be highly qualified. If at first no highly qualified persons are available in the country a qualified foreign staff should be appointed until qualified persons are available in the country. The graduates of the Provincial Agricultural College will be efficient teachers for other institutions we have proposed.

As regards the fees of the pupils we would say that education in the village schools and in the "Practical Schools of Agriculture" should be free. In other institutions the charges should be the minimum.

Funds.—"I go further and say this that if the worst comes to the worst and every other source fails which I do not for a moment think possible, I shall be prepared to advocate an extra eight anna on salt because I think it is a smaller evil that my country-men should eat less salt than their children should continue to grow in ignorance and darkness and all the moral and material helplessness which at present characterises their lives".—*Gokhale.*

Reduced to its simplest elements, the problem is one of increased taxation if more money is sought to be spent on nation-building departments. "The talk about any drastic reduction in the cost of administration is all moonshine. All practical statesmen must be able to perceive this simple truth. Even under a cent percent Swaraj Government the whole population will not become so virtuous as to render the Police Department a superfluity. Nor can the League of Nations be expected to abolish warfare and armaments. If anything, the army of to-morrow must be costlier than the army of to-day. Again the "Indianised" services

are no less clamourous about their demands than officers of "non-Asiatic" domicile. Any attempt to make "cut" in the pay of civil servants will meet with tooth-and-nail opposition—such as no government can face with equanimity. Democracy never has been and never will be an economical form of Government. The need in every province is for increased revenue. The best policy is to devise some additional revenue without delay. The state is daily becoming more pervasive and more powerful in the life of the people. Under the old *laissez faire* theory the functions of the state were restricted to the irreducible minimum—taxation was kept at the lowest level because it was generally held that money would fructify better in the hands of individual than by being driven in to the coffers of the state. Nobody holds such naive theories to-day. Money is a great power, it should be collected at the point wherefrom it can be applied with miximum advantage for the uplift of the people. It is an undoubted fact that in certain circumstances money can fructify better in the hand of the government than in the pockets of individuals. Taxation by itself is not bad; the goodness or badness of it depends on the purpose for which its proceeds are utilised. In the present state of the country the taxes can do a large amount of good if the receipts are spent on education and sanitation. It may be argued that the incidence of taxation is already too high and that any further increase would be a crushing burden. But this argument is not conclusive. Firstly, taxes may be so chosen as not to press severely on the poorest classes of people. Secondly, a high level of taxation induces people to be hard-working and thrifty. It would not at all be a bad thing if the money that is being now squandered on harmful luxuries and showy, useless, foreign articles were collected by government through taxes and spent on education and sanitation. On the contrary such a process would bring life to the people. We can go on waiting for an indefinite period expecting a great miracle by which the exchequer will be over-flowing with money without the levy of any additional taxation; but if we are in earnest we should levy fresh taxes without losing a moment and find money for the nation-building departments. No tax can be too burdensome and no suffering too great, if it were necessary for the establishment of a proper educational system." Will India recognise this? This will probably be the test of her political capacity.

FARMING ALONG THE MEDITERRANEAN SEA

II. Dairy Husbandry in Italy.

(Borrowed from "Farm Research" 1935.)

BY ROBERT S. BREED.

Italy is a country of fertile river valleys and coastal plains, and rugged, rocky mountains. While rainfall is adequate, or nearly so, in the northern regions, this does not hold true in the central and southern sections. Water problems are therefore very acute and extensive irrigation projects have been developed and are being developed to provide the water needed for agricultural purposes. Some of the river and coastal plains, like the region of the old Pontine marshes, are so low that large parts of the area are, or were, marsh lands. Drainage projects in these areas have been carried out to such an extent, however, that the amount of land that is waste because it is marshy has been materially reduced, particularly during the last ten years. Dairy husbandry, using the best dairy cattle and modern dairy barns and equipment, has been developed on some of these newly drained areas.

While the cow is the most important dairy animal, particularly in the northern Po Valley region, sheep have been used for many centuries for dairy purposes and large numbers of these animals are to be found toward the southern part of Italy in the mountain regions, their milk being used for making *pecorino romano* cheese. The goat has also played its part as a dairy animal, particularly in the less populous and more arid sections of southern Italy and Sicily. Even the water buffalo that is so important as a dairy animal in Egypt and India has found a place in the marsh lands of the coastal plains in the region of Salerno and other parts of southern Italy.

In general, there are two native types of cattle in Italy, the Alpine cattle of northen Italy which are similar to the cattle of the Swiss Alps and which tend to be somewhat darker in colour and lack the long horns of the second type, the so-called *podolian* cattle, found in central and southern Italy. The latter are large animals with the long horns known to Americans largely through the Texas longhorn cattle that came to America by way of Spain. These animals are light in colour, sometimes almost white, and make better beef animals and oxen than they do dairy animals. The *podolian* type of cattle came to Italy with the migrations of the Huns, Goths, and Visigoths, and were carried farther into the Spanish peninsula and so eventually reached America.

Because the longhorn cattle are not a good dairy type, animals of better dairy types have been imported into Italy in large num-

bers during recent decades. The dairy animal most favoured in connection with this importation has been of the type known in America as the Brown Swiss. In the newer dairy areas developed on the drained marsh lands about Rome, black and white cattle have been brought in from Holland and the lowlands of Germany. Because the native cattle are infested with ticks which carry animal malaria (piroplasmosis) some difficulty has been encountered in bringing in these animals from the northern parts of Europe. Old world countries in southern areas where the cattle are afflicted with animal malaria have not yet attempted the tick eradication programme that has been carried out in our southern states in a winning fight against the Texas fever of our southern cattle.

Cheese Most Important Dairy Product

The most important dairy product in Italy is cheese, more milk being utilized for this purpose than for fluid milk consumption. Of a yearly output of about 1,300,000,000 gallons of milk, approximately seven-tenths is used for industrial purposes, three-tenths being consumed as fluid milk. Many varieties of cheese have been developed in Italy. Authors of the Roman period (Varrus, Virgil, Columello and Pliny) describe the methods used in cheese making and indicate the food value of the different kinds and the districts which had in their time developed the most-sought for types of cheese. Two of the most celebrated Italian cheeses were developed in the 12th century in the Po Valley region, the so-called *gorgonzola* and *grana* types. The former is a green-mold cheese similar in type to the better known French *roquefort* cheese, the Italian cheese, however, being made from cows' milk rather than from sheep milk. The hard *grana* type cheeses are used for grating, the grated cheese being added to soups or to the macaroni or spaghetti that are so popular as foods, particularly in southern Italy. At the present time, 80 per cent of the sheep milk cheeses of the hard type produced in the district about Rome are being exported to the United States. During the past year, the United States imported about 30 to 35 million pounds of Italian cheese.

The next most important dairy product manufactured from milk is butter, some of this being exported from the region of Milan. A certain amount of milk is also used for making condensed milk, milk powders, casein, milk sugar, and similar products.

As in America, the fluid milk industry is better developed in the region of the large cities than elsewhere. Certain very interesting developments have taken place in this industry in Italy in the last ten to fifteen years which promise to increase greatly the use of fluid milk among Italians.

BULLOCK CART DEVELOPMENT

By Guest Keen, Williams, Ltd

Fabricated Structure of the Modern Steel Cart.

The gradual change from the well-known wooden bullock cart to the modern steel cart entirely fabricated by electric arc welding is a very interesting study.

The wooden cart, which has remained practically unchanged for many generations is, in its way, a very satisfactory machine and continues to carry a large proportion of the goods in transport throughout India.

About four years ago experiments were started with a view to developing carts which would be more satisfactory for general service, lighter in weight, more durable, and at a cost which would not be greater than the wooden carts. The result of these experiments can now be seen not only in Bombay but in very many places throughout India. General service carts of a type which are useful both for the conveyance of goods contained in packing cases or sacks and the materials with which the agriculturist has to deal with are now being produced in considerable quantities. These carts are of light steel frame construction and, being entirely fabricated by electric arc welding, there is no danger of their falling to pieces owing to rivets or bolts becoming loose or broken.

Special carts of two or four wheels design suitable for one or two bullocks have been evolved and are now being produced for the conveyance of coal, grain and all other sorts of merchandise. The four-wheeled cart with tipping body for the conveyance of coal, sand or similar materials is proving very popular indeed.

There can be no doubt that a certain amount of damage is done to the roads in this country by the comparatively narrow wheel rim of the old type cart. This has been overcome by the development of all steel wheels of a size similar to the old type bullock cart, but with wheel rims of from 2" to 4" in width or, where circumstances permit, by the use of pneumatic tyres. The all-steel wheel with the broad rim and special loose-sleeve bearings will give a life time's wear without maintenance and will reduce the rolling friction and damage to the road to a minimum.

Certain Difficulties.

Pneumatic Tyres of the large low pressure variety fitted on ball or roller bearing wheels similar to those employed on motor trucks are specially suitable for service where the roads are good, but owing to their comparatively small diameter present certain difficulties where the roads are deeply rutted as they are in many cases.

(Continued on page 230.)

SOYA BEANS*

(BY MR. M. R. DOKRAS, B.A., LL. B., CHANDUR, BERAR).

The soya bean plant is a native of Eastern Asia and one of the oldest of crops grown by man. It is an erect, bushy, leguminous and hardy annual with a woody stem carrying heavy foliage. The soya-bean plant is a mass of small pods ranged one above the other. The leaves are trifoliate and turn yellow at full maturity and fall off leaving the plant bare except for its load of pods. In Asia the cultivation is concentrated in Manchuria, Korea, and Japan. The Manchurian farmer regards it as a cash crop and it occupies 25 p.c. of the cultivated area there. The credit of realizing the commercial possibilities of the bean belongs to the Japanese whose firms sent the first trial consignment to Europe about 1907. One of the reasons why Manchuria has become of such enormous importance to Japan is the urgent need of commanding a cheap and ready food for her increasing population. Soya beans appear daily as an article of diet in innumerable dishes in Japanese homes rich and poor alike.

IMPROVES SOILS.

The soya bean plant is easy to grow and to harvest. It has a high seed-yielding capacity and being a legume is valuable as an improver of the soil for succeeding crops. It can be grown for seed, hay, and pasturage. The oil that can be pressed out of the seed commands a high price and is useful in many trades, such as soap-making, varnishes, paints, enamels, oil-cloth and other water proof goods. The oil becomes edible after refinement and it is claimed that it serves as a good substitute for olive oil also. The residues after the extraction of the oil—the cake and the meal—are high grade stock feeds. The bean has an exceptionally high protein value and contains vitamins necessary to life, making it a profitable component of human food. The staple food of the people may be said roughly to consist of meat, bread, butter and milk. The soya bean is rich in all the constituents that are found in all these four items. The almost entire absence of starch points to its use in foods for persons requiring a low starch diet. It is of great value to persons who must abstain from meat and thus is a great help to the vegetarian population of the country. Soya-bean flour can be used in making biscuits, bread, cakes and numerous other foods for infants and invalids. The dried bean provides a coffee substitute, fresh as well as condensed milk, sauces, soups and cheese. It can also be used as a green manure to restore the fertility of poor soils. Cultivation of the soya bean provides food for the people and for cattle.

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*Reprinted from the "Hitávada" of 30-5-'35.

CAN BE GROWN IN OUR PROVINCES.

The soya-bean with its many uses is the most remarkable of all legumes; yet its real value is not fully recognized or even known to the cultivators in C.P. or Berar. The slow advance is probably accounted for by the fear that it is difficult to acclimatize, but within the last four years this feat has been accomplished and soya-bean crop has been successfully grown and harvested in Chandur in Berar. It is impossible to over-estimate the far-reaching consequences of this achievement the agriculture in the province if it is eventually proved that the crop can be grown all over on a profitable commercial basis. But excepting for the sporadic attempts of a few enterprising officers, and farmers here and there, nothing has been done to encourage the cultivation of this valuable legume in the province. But there ought to be no delay, now after the experience gained at Chandur which has definitely established that the crop is capable of being grown and brought to maturity successfully in Berar. Public bodies and private farmers should encourage with energy and vigour the cultivation of the crop which has proved an undoubted success.

METHOD OF SOWING.

The soya-bean plant can grow in almost all soils which do not crack and lose moisture immediately after the cessation of rains at the end of September. The usual summer preparation by harrowing twice is sufficient for the crop. It can be sown at the end of June or in the beginning of July after the monsoon is fully established. Before sowing, the land should be harrowed once more to kill the germinating weeds. For getting good seed crop, the rate of seeding is about 12 lbs. per acre. It can be increased to 25 lbs. or 30 lbs. for the purpose of getting only a hay crop. The sowing should be done by a harrow of 2 to 4 tried seed drill followed by a woman labourer who should sow the seed through a bamboo seed funnel (Sarta). The seed should not be sown by the drill or Tiffan, as they are sown rather deep by this method and do not germinate in a good percentage. The usual cultivation with hoes about 3 or 4 in number, will suffice to keep the soil soft and kill the weeds. One weeding is sufficient, to be given at the end of July or in the beginning of August. The weeds find it difficult to get nourishment from the soil in competition with the growing crop of beans and therefore do not give much trouble. If by chance weeding becomes impossible, still the crop does not suffer as much as cotton and other crops do. Manuring is not an absolute necessity as the bean plant can get its Nitrogen from the atmosphere by natural fixation in the nodules on the roots by suitable bacteria in the soil which seem to be present in Berar soils also.

Harvesting.

The flowering stage appears in August and the crop becomes ready by the end of November, when the leaves turn yellow and fall off. The harvesting should commence when the leaves turn yellow and should be begun by cutting the plants and tying them in small bundles, like grass, for easy removal. The bundles should then be collected in heaps of not more than 4 feet in breadth and height, as otherwise, the bundles, being green, will heat in drying and the grain will be spoiled. The harvesting should be finished as soon as possible for there is always a danger of losing part of the grain, as the pods shatter after they become dry and the grain is lost in the field. The places on which the bundles are stacked should be made firm and loose earth, if any, removed from the same, for the shattering of the pods continues even in the heaps and the grain falls down on the ground below. All the heaps should be near the threshing floor and on one side of the same. The bundles should be heaped in such a way that only the stem portion will be exposed to rain or stray cattle; the other half containing the pods being concealed in the heap. Some grass or other suitable material should be kept ready near the heaps so that it may he useful for covering the heaps to protect the same from rains. After the bundles are thoroughly dried and the stems become crisp and brittle they should be united and spread on the threshing floor. The threshing should be done by bullocks as in the case of wheat, and the grain and straw separated by winnowing in the breeze as usual. After making sure that it is thoroughly dry, the grain can be put in the bin and the straw collected in the help for feeding the cattle at convenient times.

Best Addition.

I took up the practice of cultivation in 1916. Then there was no suitable rotation crop for cotton in our taluq. Groundnut was suggested to me as the best rotation and I began to sow it since that very year. The crop was then new and pigs gave a lot of trouble while the crop was standing in the field. But as there was no suitable substitute the cultivation was persisted in. The low rainfall of 1920 and 1922 was useful in lessening the number of pigs in our taluq, many having died for want of drinking water. Since the year 1923, there is no trouble from pigs. The acreage is also enormously increased and no night watching is necessary, at least in Chandur and the villages surrounding the same. The increase in acreage caused a shortage of sufficient labour at the time of harvesting of groundnut and some cultivators had to give as much as one-fourth of the share of the crop to labourers for uprooting the plants and separating and collecting the pods. My cultivation of ground nuts had reached to about 60 acres about 1929 and I also found great

difficulty in collecting the crop. So another leguminous crop which would be ripe for collection at a season other than that of groundnut became necessary to be added to the list of crops of the taluq. In reading the latest literature on agriculture, frequent references were found to the soya-bean and its importance, and the information got therein, that Japan fought wars for getting an upper hand in the affairs of Korea and Manchuria because soya-bean was one of the main crops there, that the crop takes more than four months to mature, and the knowledge that its harvest would not clash with groundnut which requires only 100 days to mature, led me to the belief that it would be the best addition to our crops in Berar.

My Experience.

A small beginning in its cultivation was made in 1931. The rainfall was nearly 60 inches, *i.e.* double that of the average, and the cotton crop was spoiled. But the soya-bean row improved and grew higher and higher till the rains ceased and put on a bumper crop which when harvested gave an outturn of more than 2,000 lbs. per acre. The acreage was increased in 1932. The crop was sown on high manured portions instead of on low water-logged ones. The seed rate given was also as high as 20 lbs to the acre. The plot grew rather thick and as there was very little rain after August the crop suffered and the yield came to only 20 lbs per acre. In the year 1933 the crop was sown in low-lying unmanured field which became water-logged in August and no hoeing or weeding could be given till October when it was weeded and hoed. The yield was nearly 500 lbs per acre. In 1934 the portions sown were again water-logged and except two hoeings in the beginning nothing could be done by way of field operations. The crop had to be separated from the grass at the time of the harvesting but yielded nearly 350 lbs per acre in an unmanured portion and 800 lbs per acre in a manured portion. Some friends to whom a little seed was given for experimental sowing reported a crop of 209 lbs per 6 lbs sown, even in water-logged soil. I got a crop of 7,000 lbs in this year.

A Helpful Crop.

From my experience during the last 4 years it is proved that soya-bean yields best in years of abnormally high rainfall, in fact it is the only crop which increases in yield according to rainfall; the higher the rainfall the better is the yield. Even in water-logged and low-lying portions the plants do not die out but live and put on a tolerably good crop after the cessation of the rains. The crop does not suffer as much for want of weeding as cotton and other crops do. The abnormally high and late rainfall of the last 2 years prove the necessity of introducing a crop which instead of being badly affected by it would improve with the rains,

This crop gives a tolerably good yield even on portions where cotton and oven Juar get rotten by too much moisture. The crop when it is given 12 lbs seed (worth Re. 1) per acre can be grown on any soil where Juar crop can reach maturity. The rains in October, which cause a lot of damage to the cotton crop and ruin the cultivators of the province, will assure an increase in yield of the soya-bean acreage sown, thus offsetting the loss in the cotton acreage.

Best Cattle Feed.

It is therefore advisable to cultivate the soya-bean in portions of fields which are likely to be water-logged in the rainy season with a certainty of good crop therein, and also in small portions of good land which do not crack after the rains cease, for trial, with the hope of full success if the rains are abnormally high. It is necessary for local oil mill-owners to get all up-to-date information about the extraction of the oil from the beans and its refining. It is also equally necessary for local scientists and public bodies, which give scholarships for study abroad, to arrange to encourage students to learn the technique of turning out all the above-mentioned trade articles from the soya-bean oil and arrange to start factories where these can be manufactured locally, and thus lay the foundations of new local industries. Till this is arranged, the crop can find a ready market as beans for export, with the aid of the recently organized marketing organization of the Central Government and the officers in charge of marketing of crops specially appointed for the province, a part of the same being utilized locally as the best cattle feed for bullocks and milch cows and buffaloes.

(Continued from page 225)

Comparative tests with the old type bullock cart and the new type fitted with pneumatic tyres have shown that the pneumatic tyre does practically no damage to the road surface and when fitted on a wheel with ball or roller bearings considerably reduces the effort required from the bullocks.

Specially designed carts suitable for handling town refuse of all descriptions are now a practical proposition The majority of these have been fitted with pneumatic tyres, and these tyres have so far given good results in municipal areas.

The increased load amounting to 60 to 100 per cent. with the new type of cart is likely to make it a formidable competitor with the motor vehicle of similar carrying capacity, as the new type of bullock cart has many advantages, especially in the transport of liquids, such as petrol, kerosene and water.

The development of the all-steel bullock cart has automatically resulted in the similar development of various kinds of hand-carts and many of these in varying designs, both with all steel and pneumatic tyres, are to be seen in constant use.

RURAL HOME SECTION

By Mrs. Sam Higginbottom

The Southern Workman, the monthly magazine of Hampton Institute, writes of the tributes paid a graduate teacher who had recently died thus:—

"No person was ever honoured for what he received. She is honoured today for what she gave in nearly half a century of a busy, useful life to others that they see by her example the abundant life, the useful life, the life beautiful!"

We rejoice in the frequent letters of our graduates who can tell of their acts of service to India and of their longing to be back again in the atmosphere of the Institute where to serve is easy. They tell of the unhappy condition of people in their present environment. In some cases the graduate has returned to his home environment and sees difficulties which he had never before noticed and concerning which he wishes help or advice.

A party of us went this week to visit the village where for two years the Students' Social Service League has carried on a school for little boys. The teacher is a *maulvi* resident of the village and has gathered into his school over thirty boys from the surrounding villages. We thought it a good idea for the women to co-operate and have a girls' school, and also to ask Government to rent or buy a couple of acres for a play ground and gardens. We would also like to ask Government for a well. When we asked the people where their wells are they raised their hands to heaven and said, "These are our wells." It was raining just then. Near the village is a *nulla* and a pond. In this muddy water people were bathing and drinking and drawing water for cooking. In the party was Mr. W. H. Wesley, Professor of Zoology at the Institute. He remarked that when he had wanted some bacteria he had come to this pond and found all he wanted.

Yesterday, I again visited the village with Mrs. Pugh and the young women who are to spend their mornings there helping the girls and women. Five women came bringing seven girls. We washed the girls' heads and combed them, gave two baths and sent one home with a piece of soap to take a bath. She was a mass of sores; we used medicine on eyes, ears and sores. Meanwhile Mrs. Pugh cut out *kurtas* and began to teach the mothers as well as daughters how to sew. Later the girls had a little reading lesson and some games. But many of the children are undernourished and sick and one child crying of hunger was being hushed by the mother. The mother said, "If I feed it now where will the food come from for the noon meal? We haven't enough for both times." It was then nine o'clock.

To our graduates who are trying to better such conditions let me say to you, "No person was ever honoured for what he received;" so give of your best to India's village children and you are laying up treasure in heaven as well as receiving honour from men.

On July 24th, I had the great pleasure of showing Lady Willingdon over the Leper Asylum. During the night there had been much rain and as I reached the Asylum hospital, although it was not actually raining, the clouds hung black and heavy like a canopy above us, light sky below. I asked the Muslim *daroga* who was in charge of police supervision if he thought it would rain soon. His reply was "There is no hope of escape. Look at the clouds above." So I said to him and to the hospital staff, "Then pray God that it won't rain just while Her Excellency is here." They all nodded their heads reverently. In less than a minute it was raining so hard that it even beat through the tiled roof of the hospital and we were all hunting for a dry corner where we could save our clothes. In ten minutes it stopped leaving a smiling sky above and just then the party arrived. The Surgeon to the Viceroy, Colonel Ross Stewart, and the Military Secretary were with Her Excellency besides the Collector. We hastened through the Asylum, although Lady Willingdon kept begging me not to show my American hustle by driving her on past all the interesting things she wanted to see. But I must pass over that part of the day to tell about the beautiful Home for the little children of lepers which Lady Willingdon opened. This new home is next to the Home for Untained girls of leper parents. After showing Lady Willingdon the Girls' Home we walked over to the new one. Outside, in front, a tent had been put up and there sat about 40 ladies, some of them *purdahnashin*. I had been told I must not present more than three ladies, but Lady Willingdon went on and shook hands with every one.

There stood 47 little children all under 5 years of age waiting for their new Home. So after Mrs. Rice had prayed—a beautiful prayer—dedicating the Home to the service of these little children for the sake of Him who said, "Suffer the little children to come unto me," Lady Willingdon unlocked the door and entered letting the babies follow. They sat around on the floor and the ladies entered. Then Lady Willingdon spoke, saying how glad she was over any work for lepers and that especially here their children could be taken, protected and cared for. The new Home has a kindergarten room downstairs and sleeping room upstairs with bath rooms made convenient for little tots. Then besides rooms for matron and workers we have a sick room with a convenient bathroom and shelves for medical supplies. The whole home is an improvement over the old one and a dream come true.

I told Lady Willingdon it had been been part of my dream that she come to open this Home. She is great not because she is Lady Willingdon, Vicereine of India, but because she gives of herself freely. In the Asylum she shook hands with every worker, even with some cured lepers. She broke a tiresome journey on a hot, rainy, sticky day to visit a Leper Asylum and open a Home for their children. The Viceroy and Lady Willingdon deserve to be great among us for they are willing to be servants of all. Again, "No person was ever honoured for what he received." To our many friends and our old students we invite you to come and see this new Home for little children of lepers.

REVIEWS AND ABSTRACTS

The Rothamsted Report for 1934 (pp. 209, Price 2/6d. Obtainable from the Secretary, Rothamsted Experiment Station, Harpenden, England). The Rothamsted Experimental Station is one of the outstanding institutions which are carrying on research work in the fields of agriculture. The Institution is especially carrying on the very important studies in the fields of soil science, plant nutrition and plant diseases. There are the well-known experiments on the parent farms at Rothamsted and Woburn amplifield by similar trials at a number of outside centres. In addition the laboratory workers are applying the methods of chemistry, physics and biology to the many problems arising in crop production and utilisation. The appearance of the Annual Report for 1934 enables all interested in the land to obtain a clear view of the recent activities of the station. Agricultural advisers, teachers and students as well as the growing body of well-informed farmers derive from its pages a considered statement of the results of the past year's experiments on plant nutrition and plant disease. Agricultural scientists will find 9 welcome features in a series of review articles on the contribution of certain of the Departments to their respective branches of Soil Science. The Report also contains a useful summary of the Rothamsted work on virus diseases. It has been found, says the report, that the inoculation of a plant with one strain of virus may protect it against a later inoculation with another more virulent strain of the same virus. The part played by insects in the transmission of these diseases is discussed in the height of recent experiments.

Bloat in Cattle :—This condition is caused by the formation of gas in the paunch with results in abnormal distension of the stomach, causing death in several cases. This generally occurs in the monsoon season, where there is an abundance of succulent

and unmature green feed. Cattle kept hungry for some time and then fed with such feeds are more susceptible to it.

Some of the remedies recommended are the following: (1) Use a gag to keep the mouth open until the animal has belched the gas out. (2) Administer an ounce of bicarbonate of soda and an ounce of ginger every two or three hours until the animal is relieved. (3) Puncture the left side of the paunch at a point equi-distance from the last rib, the edge of the loin bones, and the angle of the paunch. The proper instrument to use is a trocar and and a canula, the canula being a tube or covering through which the trocar, a sharp instrument, passes. The instrument is thrust into the rumen and the trocar is then withdrawn leaving the canula in place for the gas to escape through it.—*Queensland Agricultural Journal, April, 1934.*

NOTICE TO READERS

The next issue of THE FARMER will be devoted entirely to the report of the Rural Life Conference at Mussoorie during the last summer.

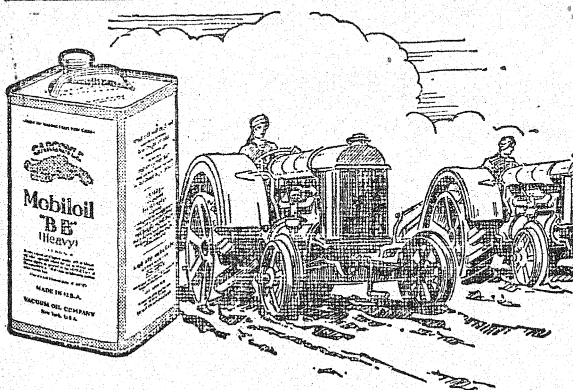
METEOROLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE

June, 1935

Date	Maximum Temperature.	Minimum Temp.	Mean Temp.	Percentage of Humidity.	Atmospheric Pressure	Rain for the day.	Rain since Jan. 1	Wind direction.	Remarks.
1	112·0	86·0	99·0	20	29·14	Nil	1·67	W.S.W.	Levelling continued.
2	110·0	80·0	95·0	16	29·12	,,	,,	W.S.W.	Ploughing fallows for crops continued.
3	111·0	82·0	96·0	12	29·11	,,	,,	W.S.W.	
4	112·0	81·0	96·0	10	29·18	,,	,,	N.E.	Harvesting 'Bajra,' fodder, napier and guinea grasses upto the middle of the month.
5	114·0	89·0	101·5	20	29·20	,,	,,	W.S.W.	
6	113·0	88·0	100·5	18	29·24	,,	,,	S.W.	
7	112·0	82·0	97·0	16	29·28	,,	,,	W.S.W.	
8	113·0	86·0	99·5	20	29·25	,,	,,	W.S.W.	Sale of Bhusa continued.
9	114·0	86·0	100·0	16	29·24	,,	,,	W.S.W.	
10	108·0	90·0	99·0	16	29·28	,,	,,	S.W.	
11	108·0	88·0	98·0	50	29·26	,,	,,	S.W.	Manuring of fields over.
12	112·0	82·0	97·0	55	29·26	,,	,,	S.W.	
13	112·0	86·0	98·0	39	29·22	,,	,,	S.W.	
14	108·0	90·0	99·0	35	29·20	,,	,,	S.W.	
15	110·0	94·0	102·0	36	29·16	,,	,,	S.W.	Final cleaning up of the threshing floor of Rabi grains.
16	111·0	92·0	101·5	42	29·14	,,	,,	S.W.	
17	109·0	94·0	101·5	41	29·22	,,	,,	E.	
18	106·0	88·0	97·0	67	29·24	·06	1·73	E.	
19	99	85·0	92·0	71	29·25	Nil.	,,	E.	Cultivating maize and Banda crops at times.
20	104·0	84·0	94·0	67	29·10	·14	1·87	E.	
21	105·0	87·0	96·0	44	28·99	Nil.	,,		
22	107·0	89·0	98·0	53	29·16	,,	,,		
23	103·0	88·0	95·5	55	29·24	,,	,,		
24	104·0	88·0	96·0	67	29·19	,,	,,		
25	97	86·0	91·5	77	29·17	,,	,,		
26	97	85·0	91·0	74	29·20	·27	2·14		
27	100·0	84·0	92·0	70	29·24	Nil.	,,		
28	100·0	89·0	94·5	59	29·21	,,	,,		Transplanting chilli and Brinjal seedlings.
29	103·0	74·0	88·5	90	29·16	3·50	5·64	E.	
30	85	78·0	81·5	..	29·16	0·20	5·84	E.	

July, 1935

Date.	Max. Temp	Min. Temp	Mean Temp.	Percentage of Humidity.	Atmospheric Pressure	Rain for the day.	Rain since Jan. 1	Wind direction.	Remarks.
1	90	80	85·0	85	29 16	·08	5·92	N.	Due to the rain on 29th June levelling suspended and got busy in preparing fields for and sowing Juar seeds and finishing by the 17th of July and then started ploughing fields of Bajra.
2	95	90	87·5	90	29·18	·68	6·70	W.	
3	94	82	88·0	85	29·18	Trace	"	N.N.W	
4	94	76	85·0	92	29 08	·42	7·12	W.	
5	94	78	86 0	85	29·10	Nil.	"	E	
6	94	83	88·5	88	29·09	1·31	8·43	E.	
7	95	83	89·0	85	29 10	Nil.	"	E.	
8	96	83	89 5	86	29 12	0·05	8 48	E	
9	98	82	90·0	82	29·07	Nil.	"	N.E.	
10	91	78	84·5	94	29·02	0·16	8 64	E.N.E.	In the first week also sown sannhemp seed for green manure.
11	84	76	80 0	90	29·10	0·29	8·93	"	
12	90	80	85·0	84	29 20	0·01	8·94	W.	
13	96	80	88·0	82	29·25	Nil	"	E.N.E.	
14	88	76	82·0	94	29·22	0·86	9 80	W.	
15	91	77	84·0	86	29·23	0·05	9 85	E	Cleaning up grasses and weeds all around the farm which grow abundantly during the rain.
16	93	78	85·5	85	29·24	Nil.	"	E.	
17	93	82	87 5	84	29·18	"	"	E.N.E.	
18	93	82	87·5	80	29·15	"	"	"	
19	94	76	87 5	88	29·18	2·36	12·21	"	
20	91	80	85·5	92	29 17	0 04	12 25	"	
21	90	78	84·0	95	29·12	0 67	12·92	"	
22	94	82	88·0	94	29·[illegible]8	0·22	13·14	E.	Cut Napier and Bajra fodders for silage till the end of the month.
23	92	81	86·5	96	29·12	0·80	13·94	W.	
24	88	80	84·0	98	29 12	0·40	14 34	"	
25	88	77	82·5	93	29·03	1·35	15 69	"	Planted some more maize and brinjal and chillies.
26	88	79	83·5	94	29·00	3 77	19·46	E.	
27	90	80	85·0	93	29·06	0 25	19·71	"	
28	91	81	86.0	92	29·08	0·22	19 93	W.	
29	90	80	85·0	90	29·05	0·19	29·12	E.	
30	91	80	85 5	88	29·08	0·19	29·31	"	
31	87	80	83·5	86	29·12	0·07	29·38	"	



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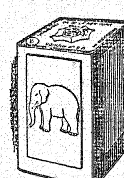

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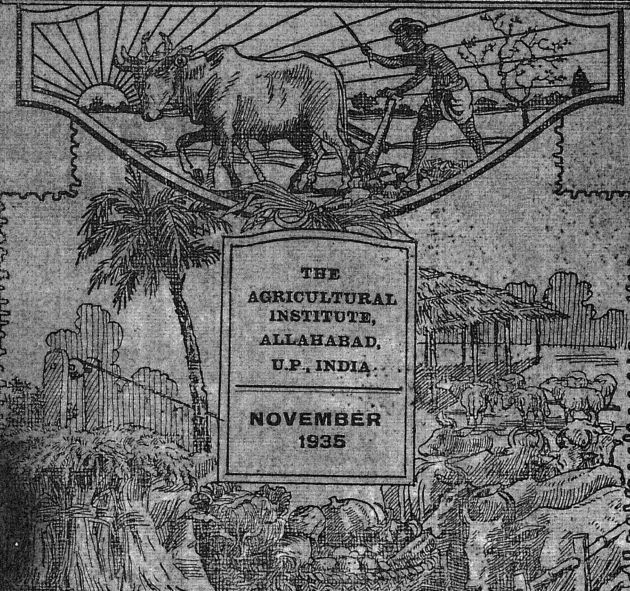
VOL. IX] [No. 6

THE ALLAHABAD FARMER

A bimonthly Journal
OF
Agriculture and Rural Life



THE
AGRICULTURAL
INSTITUTE,
ALLAHABAD,
U.P., INDIA.

NOVEMBER
1935

"Any programme for the village must meet the needs of the men, women and children of the village. The home is the basic unit of any society or civilization. As the home is, so will the civilization be."

—Dr. Sam Higginbottom.

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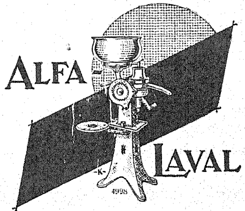

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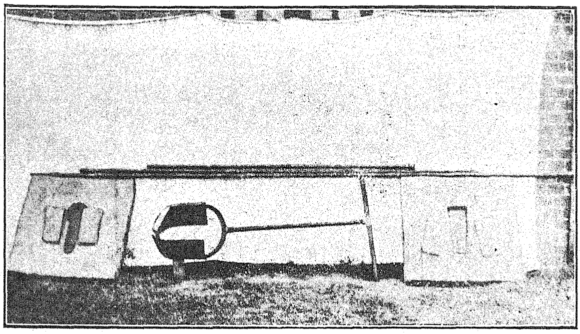
The Bore-hole Latrine



THE LATRINE BORER AND SEATS

"The bore-hole latrine combines utility, and sanitation and protects the health. If properly made, dangerous flies do not go into it. There is no bad smell from it. It hastens decomposition, deodorization, and germ destruction. It is inexpensive, and within the reach of the poor family. A good bore-hole latrine can be built for a family or a school at a cost as low as one rupee if the family or school children and teachers will perform the labour themselves, as they very well can." For complete description see the article on the Bore-hole Latrine published in *The Allahabad Farmer*, Vol. VII, No. 2, March, 1933, pages 92-96.

Balrampur (Oudh)
August 24, 1935.

Agricultural Engineer
Allahabad Agricultural Institute

Dear Sir,

...You are at liberty to publish any part of our letter as an advertisement in your paper. In fact, from what we have seen of the Wah-Wah plough, we are led to believe that the publication of the advertisement is more in the interest of the cultivators than it is of yours.

Thanking you again for the excellent service and advice,

Sincerely yours,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

Agricultural Engineer
Allahabad Agricultural Institute

Dear Sir,

We are very grateful for your letter of the 25th July last and for the plough. We had the plough weighed against a Meston plough, and found that yours was lighter by $3\frac{1}{2}$ seers.

It will very well meet with our requirements. We also started using a........plough, and found that the share broke and the wooden handle of the plough also gave way under the strain. We have in fact found all your ploughs very useful and visitors to our farm have very much appreciated these, and we believe two parties also placed orders with you at our instance. We feel confident that the improved "Wah-Wah" bottom plough will very quickly displace the........type plough.

Yours sincerely,
per pro Kalyan Singh & Sons
(Signed) Jaswant Singh.

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

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Contributions

The ALLAHABAD FARMER is published in the first week of each alternate month commencing with the month of January. Contributors are requested to send in their articles at least one month prior to the next prospective date of publication.

Contributors will receive 15 reprints of the article published and additional copies at cost.

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The Allahabad Farmer

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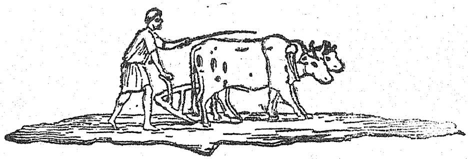
AND RURAL LIFE



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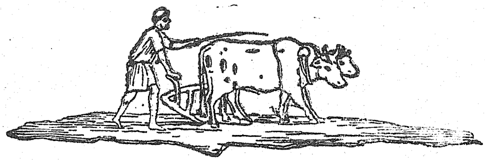

VOL. IX] NOVEMBER, 1935 [No. 6

Editorial

"Scrub Bull Legislation

In order to improve the cattle of this country, the Agricultural Departments in several provinces have been trying for some time the breeding of bulls which are distributed to the villages in the provinces. Such a method is highly to be commended. But it does seem however that the process of improving the cattle of any district is very slow indeed. The improvement in respect of the yield of milk has not been appreciable. Neither do we see much improvement in the draft quality of the bulls in the districts of, for instance, the United Provinces with which we are most familiar.

Another method adopted by the Government of several provinces was by breeding with foreign bulls whose breeds have a reputation of giving high yields of milk. But this method has of late had certain reactions in some quarters, so much so, that it has even been discouraged. We, however, do not agree with those who think that this method should be abandoned. We do not believe that the improvement in the yield of milk can be increased considerably in any existing breed of cows in India by the simple method of selection, as we must have, as our Animal Husbandry expert at the Agricultural Institute used to say, good cows amongst those from which to choose before one could select.

However, there are breeds of cows in this country whose milk yield could be improved to some extent by certain methods that the Government, we believe, can take up. At least we believe that the cattle in the village could be improved to a certain extent by requiring, for instance, all stud bulls in the country get a license if they are used for public service. In England, we understand, subsidies are given largely to small-holders enabling the use of a sire of a higher standard than would otherwise have been possible. Ireland even went further in that it does not allow a bull to exist that is not likely to have good stock.

We have no doubt but that if such legislation is adopted that there would be a great deal of improvement in the quality of our cattle. On the other hand we usually find bulls, usually scrub bulls, that have been bought because they could be obtained at a very low price, and then let loose in the country. These bulls are mostly responsible for the production of undesirable stocks and for the deterioration of cattle in this country. A legislation of some kind that would prevent this haphazard breeding of cattle would, we believe, help to improve the quality of our cattle.

*　　*　　*　　*

Wanted Seed Farms

We sometimes get letters from our readers who complain that the Government farms in their districts cannot supply them with the seeds of improved varieties of crops grown in the locality. This is very discouraging, as we know that one of the objects of these district farms is to supply seeds of improved varieties of crops to the farmers.

We however believe that sometimes Government farms may not be able to cope with the demand for these improved seeds, and that there is therefore scope for adventurous young men to take up this task of supplying the farmers with such improved varieties of wheat like Pusa 4, Pusa 12, Cawnpore 13 and Pusa 111, of Barley like Barley T.21, T.24, or T.25 which are standard varieties of barley; or of some of the improved varieties of sugarcane like Co. 210, Co.213, Co.312 and Co.313, or of tobacco like T. No. 142 and T. No. 177, and so on.

The Agricultural departments will do well if they will subsidize certain young men who have had Agricultural training if they would grow in their farms only the improved varieties of crops. There are many such young men now who are successfully employed in farming all over these provinces. Sometimes the most important limiting factor for the growing of several improved

varieties on the farm is the storage facilities that one would like to have. Certainly the growing of only one variety makes the work on the farm much easier than when several varieties are grown. Such farmers therefore who would grow these crops chiefly for seed purposes, if they get some encouragement from the Government would be of immense benefit to the peasants of the district in which they are located.

* * * *

Agricultural Graduates

During this month we have had very encouraging news from some of the graduates of the Agricultural Institute. It seems that this Rural Development Scheme in these provinces is absorbing several of our former students, amongst whom are: Messrs Veda Nand B.Sc. Ag.; B. P. Kanoujia, B.Sc. Ag.; M. L. Tarlekar, B.Sc. Ag.; N. N. Chaturvedi, B.Sc. Ag.; and P. B. Johri, I.D.D.

We have no doubt that these men are well qualified for the work for which they have been selected and that they will acquit themselves creditably.

We also congratulate Mr. N. K. Joshi, I.D.D., a former student of the Agricultural Institute, on his appointment as inspector of industries in the Government of the U.P.

* * * *

Mussoorie Rural Life Conference

The whole issue of THE ALLAHABAD FARMER is being devoted this time, as has already been announced, to the papers and discussions at the Rural Life Conference at Landour, Mussoorie.

The Conference was the first of its kind and we hope that it will continue its meetings, discussions and deliberations and that it will add to our knowledge of the problems that face the Indian farmer and also offer their solutions.

As each member of the Conference is connected with rural development of some kind in his district we have no doubt but that the solutions offered would be of practical value in the carrying on of their work in their districts.

MUSSOORIE RURAL LIFE CONFERENCE PAPERS AND DISCUSSIONS

Short Term Schools for Village Girls

By Mrs. W. W. Duff.

The Christian world is awakening to a new realization of the importance of rural communities, and we, as missions, are trying, though very slowly, to bring old policies into line with this new emphasis. I have been asked to tell of an experiment with short term schools for young women and girls from the villages.

Our pupils are young women from 12 to 21 years of age, either married or unmarried. The term has been 10 to 14 days; it should be longer. The "fees" are 8 annas or its equivalent in *ata*. Our staff consists of one young woman, the wife of a village teacher and a good housekeeper, as matron; one older woman to supervise the girls' cooking; one trained young Bible teacher; one padri's wife as teacher of sewing and knitting, one agricultural expert from the staff of Moga school to teach gardening; one missionary woman to teach baby care; and two young married men, members of the Normal Training Class, Moga, to teach reading supervised by Miss Smith of the Moga staff. Our purpose was not only to have the latest teaching methods but also to begin breaking away (cautiously) from the completely *purdah* idea!

The girls were housed in a two-room, mud house, with verandah and courtyard and a raised floor in one corner on which were mud stoves. Adjoining were a store-room, bathing room, a bore-hole latrine, and a few shaded trees to be used as a school-room.

A brief ritual, easily memorized was repeated at the beginning of each day as a worship service and a motto was chosen: "In love serve one another."

The Curriculum.—1. Homecraft. The girls made their own beds and took turns in sweeping, cooking, and carrying water. They plastered and decorated their home with patterns in white clay. We stressed personal cleanliness of bathing, washing the hair and clothing, and eliminating lice.

2. A Bible hour on such practical topics as Christian marriage, the Christian home, prayer, and neighbourliness. Each girl had a notebook into which she pasted illustrations of the Bible and health lessons she learned.

3. Cutting and sewing garments,

4. Knitting or Crochetting.

5. Soap making.

6. Gardening of a simple and practical sort.

7. Reading taught by the Moga method. There was keen interest and rapid progress.

8. Baby care—both theory and practice. Our infant victims learned to enjoy daily baths, four-hourly feeds, and undisturbed naps in separate cots.

Recreation.—A very special effort was made to have lots of fun—Indian folk games and hilarious western games, trips to places of interest in the city, picnics, parties, and evening sings.

Results.—When the school was over each girl proudly took home the following things to show to dazzled village neighbours:

1. The Bible and Health notebook which she had made.
2. The Primer which she could read.
3. Good seed which she could plant.
4. A pair of bootees which she had knit.
5. A cake of soap which she had made.
6. A gay certificate of "graduation" which she could hang on her wall.
7. A small spark of the "life abundant" which not all the deadness of her Punjabi village would ever be able altogether to quench.

Home Sanitation.

MR. MASON VAUGH.

In the time available, it is not possible to treat the subject of home sanitation exhaustively. I assume that everyone here is familiar with the general principles of the different methods of sanitary disposal of human wastes and therefore we need not discuss them. I will therefore confine myself to some observations which I think may be helpful in introducing methods better than those in common use.

I may as well confess that I have had little personal experience in the actual introduction of sanitary appliances into village homes. My part has been largely the furnishing of plans and equipment to others. Nothing has been supplied without first thoroughly testing it to make sure that it would function.

My first observation is that the village as a whole is not interested in our idea of sanitary disposal of filth. The methods in use are time honoured and in general people are satisfied and not anxious to do anything different. The first problem we face is to

convince them that there is a real need for something different. Health, convenience, modesty may all be used as arguments.

In my opinion, the idea of better sanitary conveniences must be introduced as an individual family proposition. I am convinced that there is no place in the villages of North India for the public latrine. My reasons for saying this are as follows:

1. It requires the co-operation of a number of people to build it.

2. Responsibility for cleaning and upkeep is difficult to provide for. This requires not only short time, but permanent co-operation which is non-existent in the village.

3. It requires the women to leave their homes and go to a central place, leaving the situation no better than at present in that respect.

4. The common public latrine has been the cause of more quarrels than perhaps any one other thing on mission compounds due to funny or obscene remarks made to the women, especially the young women.

I feel sure that the best argument we have for the introduction of improved sanitary appliances in the village home is the comfort and convenience of the women folk. The health argument will not be convincing to many and comfort and convenience will make little appeal to many men. It makes a definite appeal to the women folk and to the men as applied to their women folk.

Campaigns to sell the whole village at one time on any proposition are not worth the effort. Progress will be made much faster and with less effort if we select, not one but three or four, families who can and will do something and get them to act. One alone will rarely make the move to adopt a new thing. If two or three move together, their installations can be used as demonstrations and the desire to "keep up with the Smith's" will lead to the spread of the idea faster and easier than if we try to convert the whole village at once.

Now just a few words about the method to advocate. For schools, dormitories and hospitals the only suitable method is the septic tank.

Where the soil is suitable, I consider the borehole latrine to combine more advantages than anything else. Any soil deeper than 15' feet may be used. It is cheap, easily made by a single family, does not require a water supply and does provide the advantages of sanitary disposal of filth, convenience and lack of objectionable smell. One borehole should be provided for every 5 or 6 users.

Where the family can bear the expense, where land for disposal of the water is available and where there is sufficient water available, the septic tank is an excellent method.

Improving the Diet of the Village Home

MRS. CHARLOTTE WISER

In trying to improve the diet of the village home, our first step is to learn what foods are available in the particular locality. Until transportation of food stuffs is more practicable, each village depends largely on foods produced around it, and there is little point in suggesting foods from outside its area. In studying foods available, we should include wild as well as cultivated foods, such as the berries gathered by the children; and foods within reach of the poor who have no fields of their own, such as mangoes, and tips of mustard and gram plants. If we emphasize the value of the best of these "free" foods, our people might make more effort to gather them, wherever permission is granted.

Along with our study of foods available, we should find how these foods are prepared for eating. Sometimes the value of a food is destroyed or lowered in the cooking. As I have studied methods of preparing food in the village, I have been impressed by the way in which most of the good is conserved—whereas we often lose it in refining processes. One exception is the transforming of butter into ghi, which is of lower food value. Unless we are sure that the customary methods are wasteful or harmful we should hesitate to suggest new ones.

The second step is an analysis of the foods available to ascertain which ones we should emphasize. This we can do with the help of tables already prepared, and the help of agencies such as the Indian Research Fund Association, Coonoor. Tables at present available are chiefly those for Western foods, and can only be used in comparing values, and not for determining exact values. It is interesting to note how often foods shown to be valuable on analysis are those rated high by the villagers.

With all of this material in hand, we are ready for the third step—suggesting to the village housewife what foods she should add to improve the strength of her family. The foods which are there are usually satisfactory, but not enough. My experience has been that the diet can be made fairly adequate with the addition of more whole milk, and the fruits and leaves which the children and women can gather without expense. In the village I know best, the Hindus—and they predominate—refuse to eat meat or eggs, and our Christians are likewise limited, unless one of them kills a pig. In connection with our promotion of chicken and egg production among Christians, I wish that we might emphasize the value of eggs for the use of the family, as well as for the market. It is possible to build up a good diet without meat or eggs, if very large quantities of leafy vegetables are included—almost more than a human can consume. Milk is probably the most needed addition,

with its protein complete for body building, its calcium and phosphorus, and its vitamins. In our village it was regarded as a source of ghi and was seldom drunk fresh. If mothers refuse to part with their full quota of ghi, we can urge them to give the buttermilk to the children and the women of the family who have babies, rather than to the men, as is now the case. Fortunately the buttermilk which comes from the whole milk as it does in the village, has more food value than the buttermilk of the West.

With the exception of religion, there are probably more prejudices regarding food than any other subject. Everyone has ideas on what foods may or may not be eaten, and when. Certain foods which we value highly, such as tomatoes and onions, were taboo in our village. It will take much patience and tact, to replace these prejudices with an understanding of food in its relation to the body. But it is worth the effort, specially for the children.

Child Welfare.

MRS. A. S. B. MILLER.

As the result of a year's test, it was found that the average weight of village children was more than ten per cent. below the average weight of all children of similar ages. Of these village children, however, there were two who were up to the average. Both of them came from homes in which milk and eggs were eaten.

Now, the babies of the Christian community are weighed monthly. We hold baby shows along with our rural melas. This year we had thirty entries in the baby show. Each entry got a cake of soap and the winners received clothing for first prize and cloth for second prize. We advertised the baby show sufficiently ahead of time so that the babies could be got ready for the competition. Health dramas, also, are given at the melas.

Kitchen Gardens.

MISS E. HIGGINBOTTOM.

In connection with our school near Naini, we made many attempts to raise gardens in the courtyards of the children but with no success due to the goats and the chickens. Our school gardens, however, have been rather successful. The boys are allowed to take the produce which they raise home with them. They were given seeds to sow at home as well, but the pests always won. Some of them did succeed in raising some good vegetables at the school.

I would recommend that the gardens be stressed in connection with the schools where seeds and advice can be given together.

Home Industries.

Mrs. Mason Vaugh.

For seven years I have been going regularly to the nearby village for social service work among the better class Mohammedan women. Handwork, especially knitting, has generally been the means of entrance to the home.

Some homes were interested only if I would supply all materials, needles, wool, etc. I have steadfastly refused to furnish anything. If money is not at hand, knitting needles can be made from bicycle spokes, umbrella ribs, bamboo. Where sheep are kept or cheap wool can be bought raw the women can profitably employ their time carding and spinning their own wool to be made up into sweaters and stockings.

I have taught some crochet patterns but this work is more expensive, requires closer attention producing eye strain and the cheap lace can be had in the bazar so there is little incentive for lace making. In the few homes where crochet work has been done, pillow cases, table covers, doilies and underwear trimmings have been made.

Rug weaving is interesting and can be made lucrative. The initial expense of a loom is about Rs. 12-8-0. Tibetan rug weaving can be learned in three lessons or less time if one's pupil is apt. The string for the loom can be obtained in bulk from any of the various cotton mills. I got my material from the Cawnpore cotton mills. The wool for rugs is a bit expensive. Camel's wool available in some places can be hand spun. An individual with only a few sheep cannot obtain sufficient wool. It must be bought in quantity; then the carding and spinning can be done in the home. The cheapest wool I have found has been coarse hand-spun, home-dyed wool at Re. 1-8-0 per pound from Mirzapur but it breaks quickly. Cotton wool which I obtained from the Cawnpore cotton mills has been satisfactory. I ordered 12-count coloured cotton yarn and it gives a smooth, fairly deep pile.

The making of fans in the homes is an entirely indigenous work. There are beautiful designs and the material is cheap—I rather deplore the poor binding of the fans and rather bizarre and too often tawdry edges of cloth or wool attached to the binding, but I can learn much from the delicate designs and colour combinations. I am glad to encourage this industry.

Basketry is another indigenous work I have been very happy to encourage. This work is easily done, the materials are obtained from the fields and can be dyed and stored at the beginning of the cold weather for use in the long hot days of summer. Basketry

offers scope for artistic imagination in form, colour combination, design, etc. The baskets are used in the village homes for bread, sewing, etc. I have been able to sell to Indian and American friends some of these baskets and have recently had an order for baskets to be sent by private individuals to America.

Compost Making.

A SUMMARY OF THE INDORE METHOD OF MAKING COMPOST PRESENTED BY REV. G. F. BUCHANAN.

The new process described below is simpler and easier than the standard Indore process previously described, and the poorest or most ignorant cultivator can use it without difficulty or cost. The compost manure so made is like that made by the standard (containing about 1% nitrogen) and though there are some losses of nitrogen in the beginning, and the final quantity of manure is about one sixth less in bulk than with the standard process, yet these apparent disadvantages are more than made up by the saving of labour and water, where these are costly or scarce. The process varies slightly according to whether cattle are housed in a shed or tethered in the open.

Where there is a cattle shed the materials needed are :

1. All kinds of useless farm wastes, which should be collected during the year, and stored in a heap in layers as they arrive. Hard materials, such as cotton stems, should be cracked. This can be done by spreading them for a short time on a cart or cattle track. Very hard wastes, like stumps and roots, should be cracked and then left in a separate heap for a year before being used for compost.

2. Cowdung.—Only one-quarter of the cowdung collected daily is necessary, if the rest is needed for fuel ; otherwise the whole amount can be used.

3. Wood-ash should be collected from the fires and stored.

4. Earth and urine.--The top six inches of the earth floor of the cattle shed should be dug up every four months. The finer part of this urine-earth can be kept for compost making, and the rest added to fields as manure. Urine-earth is itself an excellent quick-acting manure and can be applied direct to crops. The floor is re-made with fresh earth. Wet patches should be scraped daily, and a little earth put down to prevent smell. These scrapings should be added to the heap.

Method.—Four to five [1] *pals.* [2] of farm wastes are spread on the cattle shed floor each morning; this serves as bedding for the animals, and catches a part of the urine. Next morning the surplus dung (about $\frac{2}{4}$ of the total of $1\frac{1}{2}$ *tagaris* [3] on the average) is removed for fuel if needed; about one-half tagari of dung with one tagari of urine earth, two handfuls of wood-ash, together with the used bedding and sweepings from the cattle shed are carried away, and stored on a suitable well-drained site (such as the edge of a field) to make a heap 8 feet broad, 3 feet high, and any convenient length. All materials to be rotted during the following monsoon should be collected throughout the dry weather and placed ready before the rains start.

Where the animals are tethered in the open, the mixed wastes from adjoining fields are collected in convenient places. Part of this refuse can be used for daily bedding, if the cattle are tethered near enough, and then made into heaps as described above. If this refuse cannot be used as bedding, heaps can be made, along with the proper quantity of earth, if possible scraped from where the cattle usually stand, ash and cowdung. After the first heavy showers the heaps are turned with a strong wooden rake with four or five thick teeth so as to make a fresh heap at one side or one end of the old one. The object of this is to mix the wet and dry material together, so that rain may soak in better and ensure good rotting.

About a month after the first turn the heap is again turned as before, the mixture being replaced where it was originally collected.

About a month after the second turn the heap is turned for the last time. These turns ensure the distribution of moisture, and let the necessary air into the heap.

Turning should be done on a moderately rainy day, or at least a cloudy day, so that the heap is moistened, and evaporation checked.

The time-table given is for a normal season; if the rains are delayed at any time, the time of turning should be delayed accordingly, and an extra turn given during the last stages if the heap is not well rotted.

The manure is generally ready to use in about four months and large quantities have been made in this manner during the last three years at Indore. Three loads of farm wastes will make more than a load of compost by this modified system.

NOTE.—Particularly in districts where rainfall is apt to be uncertain the process is more rapid if sann hemp is sown on the top of the heaps after the first turn. Half a chattak (1 oz.) of seed per 40 square feet is sufficient. Whatever growth it makes is mixed in with the rest of the heap at the second turn and promotes rotting.

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1. Quantities on the basis of 4 animals.
2. A stretcher made from a piece of gunny sacking 4′ by 3′, the longer edges fastened to two bamboos each 7′ 6″ long.
3. A sheet iron basin 18″ across and 6″ deep. The numbers quoted are for this size.

Open Discussion—Village Sanitation and Compost Making.

Q.—How near the water level is a bore-hole latrine safe?

Mr. Vaugh—There are no accurate scientific tests on this. The Rockefeller Foundation who originated the method in Egypt said to put the hole right into the water level. I personally prefer to leave 5 to 10 feet when there is heavy pumping nearby. There is very little liquid to percolate from the latrine and our notions of ground water movement are not based on the type of soils which we have in North India.

Q.—How close to a well can a latrine be made?

Mr. Vaugh—Where the apparent movement of the ground water is from the latrine toward the well, 75 to 100 feet is a safe distance. Where the apparent movement is from the well toward the latrine, 25 feet is sufficient. The idea that ground water moves as a sort of underground river as in western countries is not sound as applied to alluvial soils. It may apply to residual soils overlying stone.

S.—Village houses are not large enough for the use of bore-hole latrines.

A.—Most houses have courtyards at least 12 by 12 feet. This is large enough.

Q.—Does putting horse manure in the bore-hole latrine help as it does when put into a septic tank?

Mr. Vaugh—It is not necessary to put it into either bore-hole latrines or septic tanks.

Q.—How can the necessary water be supplied in the village for these?

Mr. Vaugh—For the bore-hole latrine no water is necessary. The septic tank can work on the water used in *lotas* plus one to four buckets of water per person per day. Of course more is to be preferred. In making a septic tank, one should multiply the sizes given in some American texts by about 40.

Q.—I understand the bore-hole latrine can be emptied and used for manure. Is there no prejudice against cleaning them?

Mr. Vaugh—Generally beldars will clean them after the material has rotted for from six months to a year. I believe that the success of the bore-hole latrine depends on the rise of commercial contractors who will install and clean the latrines. The original equipment is too costly for individuals to buy for their own use only.

Mr. Moore—I have assisted in starting a company in Shikohabad to put in these latrines. The biggest problem is the idea

that they will contaminate the wells. Even though the idea is wrong it is very difficult to overcome it. Often there are wells even in the small courtyards.

I would like to state our personal experience with these latrines. We have installed them in connection with our bungalow at Shikohabad, They have been entirely satisfactory. There is no odour at all.

Q.—Is the Agricultural Institute ready to make water analyses? I believe the cheapest place for getting this done is in Lucknow where they charge Rs. 50 for each analysis.

Mr. Vaugh—The analysis can be done more cheaply than that. In Allahabad, the railway hospital does it for 5 or 10 rupees. Ask your local railway hospital or public health department about it. Most North Indian wells are contaminated but they are contaminated from the top, not from the bottom. If you are trying to discover whether or not a bore-hole latrine is contaminating a well, make sure first that the well was not contaminated before and that no contamination can enter from the top of the well. The rope on the vessel used to draw water is only one of several means by which the well is contaminated from above. The only way certainly to prove contamination from a latrine is to put a detectable chemical in the latrine and then to subsequently find this chemical in the well. The Institute is not in a position to analyse water at present.

Mrs. Harper—I would like to urge you to keep after your local health officials. We put in a battery of bore-hole latrines for the school at Moga. Later some wells were found to be contaminated and the latrines were closed. Our local health officer was trying to get families to put private wells in their courtyards. This health officer believes that if we have private wells in the courtyards we cannot have private latrines. I would like to ask which is the more important, private wells or private latrines. It has been our experience that the higher officials are the more helpful in actually getting things done.

S.—A Cornell authority states that the bore-hole latrine is never safe—that only the upper six inches of soil are safe.

Mr. Vaugh—The Indian soil is entirely different from that at Cornell. At Cornell a shallow soil with rock close to the surface does make the bore-hole latrine unsafe but that is not the condition which we have in North India.

Mr. Beckwith.—While I have advocated and installed many septic tanks for schools, hospitals, and bungalows in rural as well as urban areas, I entirely agree with the statement that has just been made that the Indore compost methods offer good practial solutions for some of our village sanitation problems. I have tried

one method on my compound. It is practically costless. Night soil may also be disposed of by one of these methods.

Probably no one method of disposing of sewage is perfect for every situation. In some places one method is best, in others it is preferable to follow other methods.

Mr. Buchanan—I would like to say that leaflets describing the Indore method of making compost are available in Hindi.

Mr. Vaugh—I would disagree to the practice of putting night soil into compost. The night soil will draw flies while it is fresh and it may spread disease.

The usual size of the bore-hole latrine is up to 16 or 18 inches in diameter as a limit and as deep as is desired. The deeper the hole is the longer it will last. Our experience would place the probable limit of the depth at 25 feet; the minimum is about 10 feet.

The bore-hole latrine is not universal in its application. It should only be used where more expensive methods cannot be used. Usually the limit should be 5 or 6 persons per latrine. The difficulty of distributing the load between the different latrines makes it usually unwise to use this latrine for schools, hospitals, etc. Whenever it can be used, the septic tank is the preferable installation.

Dr. Higginbottom—I find many people willing to throw manure into a pit but very few who are willing to dig it out. Composting has been spoken of here as a health measure only but if all of India used the Indore method of making compost, India would be practically self-supporting in her needs for manure.

If fecal matter is used in manure in a pit, it is two years before the manure is ready to be used.

Q.—Does not heavy rain cause a heavy loss in compost?

A.—There is some loss due to rain, but the rain causes some loss regardless of the way the manure and wastes are handled. It is believed that there is less loss in composting than in other methods.

Q.—If human fecal matter spoils compost for four years, why is the material from the bore-hole latrine ready after one year?

A.—The difference is in the size of the column. In the bore-hole latrine, air is available and decomposition can take place. When fecal matter is thrown on to a compost heap it may be quickly covered by other wastes and thus most of the air is excluded.

Q.—Does anyone here know of the method used by the Revd. Mr. Kerr in making compost? This method was widely approved in England. In his own experiment contrasting soil untreated by

any compost, soil treated with compost made in the usual manner, and soil treated with compost made by his method, the results were of the order of 1 to 3 to 7 respectively. He carried on this experiment in Dichpalli, Hyderabad. I think he used shallow trenches in his method.

Dr. Higginbottom.—Perhaps that is the method which he got from me and which I, in turn, got from Colonel Hudson, Superintendent of the Naini Jail. In this method, one digs a trench 10 to 12 inches deep and 4 feet wide along one edge of the field to be manured. This method is for the use of night soil. The night soil is put into the trench and covered by digging a new trench of the same dimensions next to the first trench. Thus the filling of one trench opens a new one The soil used in covering is put through a $\frac{1}{4}$ inch mesh screen so that the night soil will be thoroughly covered and the flies will be kept away. This system is much more expensive and it takes more time to cover the field. It is known as trenching manure.

I would not recommend putting fecal matter into compost.

Editor's Notes.—Dr. Higginbottom reports that since the conference he has heard from the Reverend Mr. Kerr and that he uses the Indore method of making compost.

How to reach the Villager—Through Institutes and Exhibitions

MR. A. S. B. MILLER

There are three classes of missionaries. There are first those who believe their only duty is to preach the Gospel. There is a second group who believe that their job is rural uplift with no preaching of the Gospel. There is a third group who believe that both are necessary, beginning with evangelism.

The conditions under which missionaries work also vary. Some work among mass movement Christians ; some work among outcastes ; some work among those of the backward castes. This latter group is the one with which I have been working.

The people in our territory either have land or can get it. They are farmers or farm labourers. This determines the programme which we should put on.

The first Institute was held one year ago and was very disappointing. We spent very little in advertising, counting on our preachers, teachers, etc., to promote it. Twelve men came, of whom five stayed through the eight days. We are not so disappointed now as we were then because some of them went back and did something with their improved seed, etc., and the influence has spread.

All five of those men returned for this year's institute. Our programme was the same except that it was enlarged. We spent more on advertising, vernacular bulletins, etc. This year thirty-two stayed for the entire course. The programme was planned strictly for villagers but nine teachers and preachers came, stayed, and paid their own expenses. The government furnished literature on seeds, crop culture, crop diseases, etc. The villagers said that they had not known that such material existed. This is the weak point in the government agricultural work.

Our experience with exhibitions has been limited. One village asked for an exhibition, the missionaries got some good poultry, and the village set up the exhibit. The effect was not considered very great at the time but nearly every Christian family in the village has improved fowls. This year we had competitive school dramas of Indian village life. We believe that this is one of the best methods. The people are enthusiastic about it. Our melas include dramas by the schools, competitive games, baby shows, etc. So far they are not big, but the idea is growing. *We gather the things that we can have*; and try to make it self-supporting, using no foreign funds. Churches and private individuals make contributions to cover the expenses. Last year we had twenty-three rupees for prizes; that is enough. The committee has been appointed and is now getting ready for next year. We give prizes for the best country fowls and for other things—whatever the people can bring.

Discussion—Introducing Poultry and Goats into Villages

Question.—What effect has the Etah project had on the economic, social, and religious standing of the Christians?

Mr. Slater.—The effects on Christians, so for as I can see, are practically nil. As I understand it, our purpose is a strengthened Indian church. I don't see a stronger Etah church because of this work. One-tenth of the proceeds of the Etah poultry show goes to the church. The introduction of poultry to the village does increase the income of village Christians but this does not come back to the church.

Mr. Moore.—Mr. Slater is too modest. Certainly the economic status of the Christians has been improved, and this is one of our purposes. In our district where the industry has taken root, the Church income has been somewhat increased.

Question.—How many villages has the Etah project actually reached?

Answer.—Birds are brought to the Etah show from about 100 villages. Thirty to fifty villages are represented in each of the branch shows. There is some overlapping.

Question.—How are the fowls protected against the officials ?

Answer.—There have been such cases but you cannot get rid of them without changing the system.

Dr. Pickett.—In our Mass Movement survey around Etah we were disappointed in finding so little evidence of the influence of the Etah Poultry project upon the welfare of the village Christians. But in the course of the survey as a whole we came to realize that projects for bettering economic conditions achieve their largest success only when they are closely allied with a wide and deep evangelism. For years evangelistic work in and around Etah was very poorly provided for and the religious life of the professed suffered severely. Christian worship, when it is in line with the principles laid down by our Lord and interpreted in the epistles of the New Testament, smashes the inhibitions that caste, karma and other Hindu teachings have fastened upon villagers, especially those of the depressed classes, and releases powers that enable them to take advantage of opportunities for a better economic and social life. Without such a release efforts for social and economic uplift achieve little. If then the results of the Etah project have not been as extensive as Mr. Slater had hoped, I hope we will not allow our enthusiasm for economic uplift to cool, but will rather seek to correlate such efforts with a broad programme of religious education and Christian worship.

This also should be remembered. The Christians about Etah come from the sweeper community and are very scattered, averaging only about three families per village. They thereby miss the protection of fellowship with a body of people who share their lives. It is my opinion that no group encountered in our entire study of mass movements has suffered from the caste as much as have the sweepers of the United Provinces. To help them we must be very sympathetic and patient.

Economic Help for the Villagers through Co-operative Societies

Rev. E. S. Root.

Values of the Co-operative movement to the villagers.—1. The value of mutual helpfulness. Wherever successful co-operation is carried out this is found to be one of the chief benefits. It is certainly needed. There are a few co-operative efforts in farm work but helpfulness is usually remote.

2. Individual progress benefits the community as a whole and thereby the individuals are benefited again in return.

3. It discourages the idea of trying to "do" the other fellows.

4. It affords practical training in business. This may be meagre but it is a help. It teaches the need of honest, sincere, dealing.

5. It discourages the present tendency to try to get something for nothing.

6. It safeguards the villager against the unscrupulous money-lender. It gives him a chance to get sound credit.

Personal Experience in Co-operatives.—Have had a society for the last 3 years. It was organized especially to encourage small industries. It has developed into a wide range of activities. Membership is limited to the Christian community of the district upon satisfying the managing committee that the applicant is worthy to belong. Industries among our Christians were in their infancy when this was started.

Soon found demands for small agricultural loans for seeds, implements, bullocks, etc. Up till then, no Christians were in agricultural work. In the three years of the societies operation, 13 families have taken to agricultural work, not all of whom have been successful, but they have imprvoved their lot in spite of unfavourable agricultural crops. Four or five Hindus were also helped in agricultural work but the admission of Hindus is being stopped as they are difficult to handle.

Have made some loans to pay off debts. One must be careful in such cases to be sure of repayment. Such loans are usually given to those who have several small debts to pay, so that they all are responsible to pay to the Society only.

The main purpose of the society is to make it possible for people to do something productive. Loans should in most cases be for productive purposes—no loans for weddings. There are no loans for education in this society.

The general effect has been to strengthen the economic status in spite of the depression and to increase interest in family affairs.

Educational Co-operative.—One year old. Rev. Puffer started the idea. Three reasons for starting it. 1. Mission cuts made some other source than mission necessary to provide education for the children of Christians. Could no longer give concessions to children of workers. 2. The Indian Christians were demanding that their children be educated—they would rather starve themselves than to not educate their children. 3. Determination to meet the problem and to do it with local funds. In any co-operative, proper management is the only hope of success.

Aims of the Educational Co operative :—

Each Christian family should have Rs. 10 share in the society. And as far as possible one share for each child.

Arrangements are made for donations. Wedding fees are turned into this fund making membership for orphans and poor people possible.

Organization.—Limited liability society.

Bye-laws to make long term loans possible so that children after graduation can help in repayment.

Hopes. Do away with mission scholarships.

Education possible for all Christian children.

To end the dependence of the Indian Christians on foreign funds.

DISCUSSION.

Dr. Higginbottom.—Wherever co-operatives have failed, it is because of poor management

Q.—Can mission workers be included as well as villagers? (In the co-operatives of which Rev. Root spoke).

A.—Yes, all Christians may be included.

Mr. Ingram —Mr. Moore has been doing something with co-operatives among his workers. I was struck by the fact that the workers now conduct the co-operatives themselves.

Mr. Moore.—Mr. Wallace is our president and should do the reporting on our work. Our organization is for mission workers only. It has been very successful They pay their monthly dues willingly; no questions are asked. Among the 23 members they now have about 2,000 rupees. They do conduct all of the business, decide who is to get the money, etc.

Q.—How are these societies related to the Governmet service?

A.—They are registered and inspected.

Mr. Wallace.—We started Co-operative Credit Societies in more than twenty places, 15 years ago, but all of these have failed. The societies for Mission workers have succeeded.

One of the main reasons for our failure was that the rules governing the societies were in some places inapplicable to the condition of our people. For instance, one rule was to the effect that the membership of a society must be composed of at least 12 reliable men, living in not more than 2 villages in a radius of two miles. Our sweeper Christians live in such small and scattered groups that there were comparatively few places where this rule

could be fulfilled and even in those places only a part of the membership could be considered as reliable and responsible men. This having a membership made up partly of irresponsible men struck at the very heart of the co-operative principle ; namely, mutual trust and help.

We realized at that time, that, even if those societies had been successful, we had practically reached the limit of our expansion, and that the movement could not benefit more than a small section of our people.

I think that Dr. Higginbottom's statement that wherever co-operative credit societies have failed, it is because of poor management, is in the main correct. But that applies to those societies which are being conducted under conditions where the rules are workable. We discovered that we were trying to use a machine not suited to our land.

Q.—How many such societies for mission workers are there?

A.—One in Mainpuri, one at Kasganj, and one at Fatehgarh.

Dr. Wiser.—If we limit our people to productive loans, we drive them to the money-lender for non-productive loans. Often the money-lender lays hold of the produce of our preductive loan to pay his own non-productive loan. This is the weakness of many village co-operative societies as I see it.

Mr. Blickenstaff.—It is possible to organize, in connection with recognized schools, co-operative credit societies, for which the Government will give assistance by furnishing books and necessary forms at actual cost price. Such societies cannot be registered by Government but often honorary organizers will assist in the initial details and render valuable assistance from time to time. These societies, conducted by students, under faculty supervision, are of great value in training students who later take their places in registered village societies as members, secretaries and managing directors.

Bishop Lapp.—We had a Co-operative Loan Association established in one of our Mission stations for nearly 20 years which suffered no losses. However, very stringent rules had to be enforced to ensure payments. It makes both productive and non-productive loans. In Dhamtari, C.P., a loan association has been established on a co-operative basis by the Indian Christian Association. This Loan Association is registered by the Government and can take loans from the Central Bank. It is conducted by the members of the Association for the purpose of loaning for city and farm property. There is a capital of over Rs. 1,200, a membership of 24 active, investing members and also an associate membership with the privilege of borrowing. The large co-operative

loan associations of the Christian communities of North and South India which are successful should be an inspiration to us to give every encouragement to such organiations.

It was most enlightening to me to have the privilege of visiting Gosaba, Sir Daniel Hamilton's great co-operative estate, and have the privilege of looking into the accounts of the thriving co-operative society founded there. It has many sub-societies which are on a sound basis financially, growing and self-supporting. It is one of the outstanding examples of successful co-operatives in India.

Discussion—Training Rural Leaders.

Dr. Wiser.—What curriculum do we need for our village workers, especially for village preachers? I believe that we need four distinct things. We need first, of course, Biblical training. And then we need some kind of vocational training. Many people recommend agricultural training here. At Saharanpur, many of our students want training in *darzi* work. In Chota Nagpur, I found workers supporting themselves with sewing machine work. Thirdly, our workers must be trained in sociological and economic understanding. They must understand village relationships, the problems of co-operation, etc., etc.

And then our men must be trained in pedagogical ability. This is the place where Moga is the strongest, and where Saharanpur is weakest. The worker must know how to teach what he knows. The problem in the village is to change behaviour—a very difficult task but it is the point of accomplishment. Unless behaviour is changed there has been nothing accomplished. It is imperative that we include this development of pedagogical ability along with the teaching of subject matter to those whom we are trying to prepare for village work.

Mrs. Duff.—I would like to add to that the giving of opportunities to our students to practice—to do our district work. We have found that our students know less of the village than we do ourselves. Young people will become enthusiastic for village work when taken in and shown the needs but not until then. A nurse, taken into the village, was so impressed that she could not sleep and this experience resulted in her going to the village to stay.

Mrs. Benade.—I suggest that Mrs. Duff and others who know the village make a special effort to pass on this information to those who do not know of these conditions, especially students. At the Lahore Students' Conference last spring, Mr. Bulubhai Desai, the Congress leader in the Legislative Assembly, suggested that every student should plan to spend five years of his life working in the villages. This suggestion should be capitalized by those who work

in rural areas and know conditions which might be improved with the help of students. If they invited students to share in developing specific projects in the villages, I am sure students would respond heartily.

Active Christian Rural Interests and their Relation to Evangelism

BY BISHOP G. J. LAPP, DHAMTARI, C. P.

One cannot do better than to take Jesus as the example of that interest which should be maintained in connection with building up the Church of Christ in India. We have His own expression of His Mission in Luke 4 : 18, 19 and also the expression of his obligation to the poor, the broken-hearted, the blind and the bound and to proclaim the universal application of His message to the life of all that dwell in the earth, if they will but accept Him. In 7 : 19-23 we have Jesus' reply to John Baptist's inquiry in, "Go tell what things we have seen and heard." He had so clearly demonstrated His power and His place in the world's redemption that explanation was unnecessary. In John 10 : 38 Jesus' plea to his opponents is, "Though ye believe not me, believe the works : that ye may know and believe that the Father is in me and I in Him." The doings of the redeemed are also a demonstration of the power and presence of the Redeemer and stand as a witness to His grace and love. It is the understanding of this that has burdened those who have at heart the highest welfare of the village Christian community in India.

Before taking up the discussion of our subject in detail may I read the burden for the rural Christian community of our esteemed Rev. J. Z. Hodge, General Secretary of the National Christian Council, as expressed in his message to the Landour Missionary Conference, as follows :

"While it is impossible to over-state the importance of the witness of the individual and the family in the missionary scheme of things my own observation leads me to the conclusion that the corporate witness of the Christian community, redeemed, regenerated and reflecting the glory of God is even more impressive. If we stake the Christian evidence on saintly individuals or even on the ideal Christian home the Hindu and Mohammedan can counter that claim by pointing to similar evidences ; but the redeemed community is something unique in Christianity. When the Christian community is seen as '*a colony of heaven*' men cannot doubt

the reality of the Kingdom of God............Then what shall we say of the social and economic disabilities that press so heavily on the rural community, Christian and non-Christian alike? Gray's familiar lines always come to my mind when I view the Indian rural scene—

> "Chill penury repressed their noble rage,
> And froze the genial current of the soul."

We must resolve that these things shall not be and give our unstinted support to any scheme of rural reconstruction that makes the Church central and any plan governed by Christian principles that seeks to change the present unhappy social and economic order ....I regard this as a missionary method whereby we demonstrate to all who have eyes to see the reality of the Kingdom of God."

It is this practical demonstration of Christianity in and through the Village Christian community in India which is burdening us at this time. I have divided the first part of this discussion into three main heads, as follows:

1. *The Demonstration of Christian Village life.*—We have our village Christian community, in some places by tens, in others by thousands. In whatever condition we find them it is found to be true that their change of loyalty from idols to serve the living God has improved their general status. Whatever our effort or interest in special projects may be it must be for the purpose of building up, or if necessary, reconstructing the Christian village life in both mass movement and other areas. It is true that the acceptance of Christianity and the understanding that the standards set by the example and teachings of Christ and His apostles is the ideal of achievement by the Christian communities in India have led to a casting about for ways and means of improvement. A careful reading of reports published by commissions and individuals, conferences and committees convince one that there is manifest on the part of the Christian forces in India a great urge to move forward and bring to a successful conclusion the great issues that challenge the best that the Christian Church and society can produce. This great urge is expressed consciously or unconsciously for the emancipation of the whole life of the Christian community from fetters which for generations have hampered progress. Inasmuch as the village Christian lacks in intelligence, integrity, initiative, character, cleanliness and co-operation and in the capacity to appropriate and utilize new ideas and methods insomuch as it tends to hinder the effectiveness of that Christian witness—individual or corporate—which will bring the impact of the Gospel of Jesus Christ upon non-Christian India. This holds true for those of our Christian communities living in colonies or in the villages previously established among their non-Christian neighbours and friends.

2. *The Demonstration of Rural Christian Service.*—The Christian colony, the Rural service unit, the demonstration centre, the development of local industry and marketing facilities, the educational service for adults and youths, medical and social service, animal husbandry and distribution, the demonstration of improved methods along any line when administered and rendered in the spirit of Christ should certainly have the sanction of any right minded and earnest Christian organization whether Mission or Church and should be considered a vital part of the programme of Christianity in India.

But the emphasis should be on SERVICE. The criticism has been offered and rightly so that training centres and institutions are given to advertizing their *training for leadership* with the result that the student upon entering receives the impression that his training is to become a director of effort rather than one who is to demonstrate by his own personal interest and effort. We deplore that spirit in India today. The ranks of those who would be teachers and directors are overcrowded and we need to change the heart of India in this respect. This spirit is also too much manifest among many in the Christian community.

3. *The Demonstration of Christian Rural Life Leadership.*—Keeping in mind that the crest of the Christian Church is that of the basin, the towel and the kneeling servant and instilling that spirit in every man and woman who receive training or help in home or training institution, those qualified for leadership by virtue of their work of faith, labour of love and patience of hope (1 Thess. 1:3), will either find their way or be called to responsible places of leadership and through experience and sympathetic contacts will have come to understand the principles and purposes as well as the methods of building up the life of the Christian community.

We need this leadership and with the growing urge for the care of the Christian rural community the demand will take up the supply of worthy leaders as rapidly as they appear and prove their worthiness to the satisfaction of those upon whom devolves the responsibility of administration and development.

The second part of our discussion has to do with evangelism. Aside from the legitimate use of a supported ministry by the Christian Church and supported corps of evangelistically minded workers of all classes by the Mission there should be a natural development in the matter of Christian witness on the part of the Christian community. I shall treat this under three heads.

1. *The Spontaneous Expression of the Christian Life.*—The general testimony is that those in the higher social and caste circles who are coming into the Christian Church have been very largely influenced by the witness of the changed lives of the un-

touchables who had been previously won to Christ. Christian life is different and its cleansing and refining power is manifest in daily living and relationships. A spontaneous witness which tells does go out from the life.

2. *Voluntary Individual Expression of the Grace of God.*—This is ever being ready to give an answer of a good conscience toward God. With moral, social, economic and intellectual achievement and with having constructively moved forward community consciousness will also have grown and the Christian community can rightly attribute its progress to what God hath wrought in its midst and give purposive expression to this conviction and invite friend, neighbour and stranger to "Come with us and we will do thee good", and also with assurance invite them to accept the faith which has meant so much to them. Voluntary expression accompanies spontaneous witness of life.

3. *Organized Christian Witness.*—This is corporate. It is that of groups organized by any of the many bodies operating in a Church centred programme for the establishing of the Kingdom of God. It may from the angle of the Sunday School, the Christian Endeavour, the Epworth League, Christian Student Movement, or any other organization whose activities are related to a Church centred programme of evangelism. A group of workers in connection with a great Y. M. C. A. rural centre, in their witness for Christ, brought a number of souls into the kingdom and organized a new Christian community. In one Church community of the Central Provinces, groups for village evangelism are organized by the Indian Church. Congregations of 400 or less have as many as twelve such groups organized. The whole Church community has over 38 such groups in active Christian witness for Christ.

All the promises of God in Him (Christ) are yea (positive and progressive) and in Him Amen (to a finish) unto the glory of God by us, 2 Cor. 1: 20. I think I have given you the natural progression in witness in the above mentioned three points which also furnish the programme which can be effectively developed as we actively interest ourselves in the welfare of the Christian rural community of India. The (Christian) life and Christian relationships will radiate to the non-Christian community and impress it with a power in the Christian life that does not obtain in any other. This will help the non-Christian community to become more receptive to the Christian message as has been proven in many areas of India, especially where caste people are coming into the Christian Church as a result of the changed lives of the Christians who came from among the untouchable classes. This receptiveness will also react upon the Christian community and prompt it to greater readiness to witness. Let us foster by every possible means this development in voluntary Christian witness.

Day.	*Event.*
16 } 17 }	First turning, compost innoculated from another pit thirty days old.
24	Second watering.
30 } 32 }	Second turning.
38	Third watering.
45	Fourth watering.
60	Third turning.
67	Fifth watering.
75	Sixth watering.
90	Removal to field.

Shading of the compost is not necessary and economical for compost under Indian conditions.

The finally composted manure is light black perfectly decayed and quite friable and free from clumps. It has no bad smell. It is a plant food prepared outside the field and becomes readily available to the plants when applied. When ready, the compost should not be left long unapplied to the crop as then loss of its nitrogen content occurs. If a proper mixture of all vegetable wastes has been used (having a carbon nitrogen ration of about 33.1) the composted product forms an all round manure having a carbon nitrogen ratio in the neighbourhood of ideal proportion of 10-1. So a fair use of fallen tree leaves and other nitrogenous materials should be made in the compost. "Pound for pound compost manure is richer in plant food than fresh manure, because if properly cared for, nearly all of the nitrogen phosphoric acid and potash of the original manure are present in the smaller bulk. A ton (2,000 lbs.) of composted manure is obtained from about 2,80 pounds of stable manure." Mr. A. Howard says "fifty cart-loads of ripe compost per pair of oxen per annum can be made from the plant residues available on any holding. The quantity can be more than doubled when all the dung and urine earth are used, provided of course sufficient vegetable refuse can be secured." He further says "the fact that the cultivator really requires only a fraction of his cow-dung for converting all his vegetable wastes into humus, disposes once and for all of the view that the salvation of Indian agriculture lies in substituting some other fuel for cow-dung cakes. As no other suitable fuel exists in many of the villages of India, cow-dung must be utilized. Fortunately, when all the available vegetable wastes have been converted into humus, a large supply of cow-dung for fuel will still be available. The ashes however

(Continued on page 190.)

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Conference of Missionaries Interested in Rural Development held at Landour, June 1935.

By Dr. Sam Higginbottom

There is an increasing number of missionaries working in the villages, who are becoming more and more interested in a programme that reaches the whole village man. They realize with St. Paul that that which is natural is first, after, that which is spiritual. The whole man is both natural and spiritual. Our Lord Jesus ministered to both the physical and spiritual needs of those with whom He came in contact. To minister to either one and neglect the other, is to fail to follow His example or to do the best for the needs of mankind.

Many of these rural missionaries have had no special training except for spiritual ends. They go so far with their spiritual message, then find increasing difficulty in going further. Some are questioning the reasons for this and are coming to the conclusion that it is not what they have done but what they have left undone that is the cause of the tardy growth. Many with the best will in the world cannot see what needs to be done. They see poverty of body, mind and spirit; ill-health, disease, suffering, waste, illiteracy. But their eyes are holden, so that the causes of these distresses, beyond the generalization, that the people are far from God, are hidden from them.

Some have come to see that training that will help is possible. Any programme for the village must meet the needs of the men, women and children of the village. The home is the basic unit of any society or civilization. As the home is, so will the civilization be.

If children are not properly cared for, if too large a percentage of them die in babyhood, if the survivors are weak and frail due to lack of proper care, there the missionary is justified in seeking remedies and measures that will teach the village mother how to feed and care for her children so that they will grow up strong of body and mind. If through lack of sanitation, disease is endemic and epidemic with consequent high death rate, and reduced efficiency of those who survive, then the missionary is justified in striving for better sanitation, and so through every need of the villager. When the Lord Jesus saw the multitude as sheep without a shepherd, He taught them many things. He fed the hungry, healed the sick, gave sight to the blind, cleansed the leper, made whole the cripple, spoke words of hope and forgiveness to those who repented of their sins.

So the conference did not discuss the "Why" of Rural Development and village uplift. Where the need was so obvious and so

urgent they were satisfied that in the commands and example of the Lord Jesus they had ample warrant and sufficient reasons for an adequate programme.

The conference devoted itself chiefly to the "How" of Rural Development. It was a pooling of experience. It kept the interest of those present, but left most feeling dissatisfied that so much was crowded into one day. Almost any one of the half dozen topics on the programme, could have occupied the conference profitably for one day.

So with appetites whetted, but not satiated, the conference adjourned, after asking, that at least a day of the next Landour Conference be devoted to a Rural Programme.

The Depressed Class People in Travancore and the Alwaye Settlement

By V. T. George, B. A.*

The words rural reconstruction are becoming more and more familiar to the educated members of our human society through the agency of the press and the pulpit. Though the words and the idea have become very familiar to us, I don't think that we do know the problems of the villagers which with their solutions are the topics of consideration under rural reconstruction. We, the literates and the privileged of our society, do not know the need, the ultimate need of the villagers. Those of us who profess knowing the needs do not face facts and are unwilling to pay the cost of finding a solution to them. The villagers know their needs and if you are sympathetic and loving to them they will tell you what they want. In one of the meetings for the so called depressed class people in South India, the pressing need, the cry, or rather the prayer of the people was expressed by one of their own members in a very striking and challenging way. It runs thus, "O God we are hungry for love, we want someone to love us".

This need is the first and the most important of all the needs of the depressed class people of India. The need, and the hence the cry is bitter in Travancore where I work in connection with an institution for the depressed classes. The obvious reason for the bitterness of the cry is that there is no one to love them. In this

* [Mr. V. T. George, the writer of this article, is a permanent member of the Alwaye Settlement Fellowship, and is at present taking his training at the Allahabad Agricultural Institute. He would be glad to send literature regarding the Alwaye Settlement to any who are interested in it. He expects to complete his training at the Institute by the end of April, 1936

We publish this article in this issue as we feel that it is in line with the papers read at the Rural Life Conference. *Editor.*]

twentieth century when race, colour, and caste prejudices are fast disappearing, in Travancore, the land reputed as second in the matter of education among Indian States, the land which when compared in fertility with some others in India is flowing with milk and honey, the land so bountifully blessed by nature as to be called by all tourists as "the garden of India," the land which has more than a quarter of its population as the followers of Jesus, the friend of the poor and the depressed, there exists according to the last census report 1,787,380 depressed class people. This is 35% of the agregate population of the State. There are 44 different castes among them, each of which has its own customs and practices. I will not include all these castes in my list of the so-called depressed class people, for most of these are not depressed in the ordinary sense of the word. But the castes like 'Pulayas', 'Kurayas', 'Nadars', 'Vetars', 'Ullatan', etc., which number about 700,0 0 to quote the report, were sold like cattle and disposed of along with the land on which they worked and can be called depressed classes, though they ought not to be called like that. In Pichiring the condition of the people, the report continues to say, " they were not allowed to use the highways, public conveyances, hospitals and common wells or to enter or even go near the temples They had no access to the bazaars and markets even to purchase their necessities. They were not allowed to wear any valuable ornaments or even use upper garments to cover their nakedness. They had to live in mud huts erected by the sides of the paddy fields which they had to watch for their masters. They could not educate their children, nor even give them names which were usually borne by members of the higher castes". The missionaries and some organised evangelistic societies have tried to open their eyes to see their deplorable condition. Of late their work has brought home to the higher castes the consequences of the past neglect of their unfortunate brethren in the lower strata of society· The government and organised denominations of the Church have been recently working hard at their uplift. But still not much has been achieved. This is due to the unsympathetic and inhuman treatment of the people by the majority of the high-caste Hindus and the Syrian Christians. Well did Jawaharlal Nehru describe this treatment of the people thus, "One big blot covers this fair landscape, the blot of untouchability. Where nature has been so generous, man has been so narrow and selfish and has denied his brother even the ordinary rights of human being". Mahatma Gandhi also expressed the same opinion and said, "In this State only man is vile". It is pathetic and true to note that the people willingly bear this treatment with a servile mentality, and hence we find no such wrecks of humanity in God's family who bear such absolute starvation of body and soul together. They are victims of everything devilish with a big Dirt, Debt,

Disease, Drugs, Drink, Demon-worship, Destitution and Degradation. It would be a long and sorry tale to describe adequately the condition of these people for which my own people, the Syrian Christians are partly responsible. Without spending any more time on the description of the depressed classes I will request you to imagine for a moment the deplorable condition of these people who are so precious and dear in the sight of God and us who love them and serve them, and thus substantiate my description.

Now, I will turn to the second part of my paper which will be to give you a general idea about the Alwaye Settlement, a pioneer Christian work done on behalf of the depressed classes at Alwaye in Travancore, a native State in South India. But before venturing to enter into that subject proper, I must give you some idea of Christianity in Travancore so that you may have a better background to understand the work that we do there.

Tradition assigns the origin of the ancient Christian Church on this coast of Travancore, Cochin, and Malabar to the preaching of St. Thomas, the Apostle. Mr. G. T. Mackenzie in his book the "History of Christianity in Travancore" says that there is nothing improbable in this tradition. As I have already pointed out, more than a quarter of the population of the State are Christians and out of this about two-thirds are Syrian Christians. I do not want to deal with the pride of the "Syrian blood" as we call it that is flowing through our veins, but I want to point out some of the weak points about us as a community. In the first place, the Syrian Church, to use the words of Dr. Westcott, was lethargic and entirely devoid of evangelical fervour. The Syrian Christians remain as an exclusive caste like the Brahmans and are treating the depressed classes, whether Christian or non-Christain, in the same way as the Hindus. Even today the depressed class convert is an untouchable and an unapproachable to many Syrian Christians. But for this, the whole of the depressed classes would have embraced Christ as their Saviour. In the second place there is always friction and hatred among the various denominations of the Church. More money has been spent in the courts than any other single item of the Churches' expenditure.

It was in an atmosphere like this that the Settlement was started in 1927 by a Fellowship of four young men of different denominations of the Church. The parenthood of the Child Settlement goes to the Union Christian College, Alwaye. All the present Fellowship of permanent workers are old stutents of the College. They were inspired and are being inspired by the sacrificial and serviceful lives of the members of the College Staff some of whom are few of the living saints of the world while others are great intellectual geniuses The Settlement Council which is the governing body of the Institution has many of its members from the College staff.

Having realised the need of the people the late Rev. L. W. Hooper, who was a member of the College staff, and three students decided to give their lives for the cause of the people. A small plot of land was bought, a single hut was built and ten boys from various villages of the state were taken for training. The workers lived with them, ate with them, played with them and shared their very lives with them. When once love began to flow we recognized the need of improving their social condition. Swami Vivekananda said, "I know of no greater service that the better class can render to the depressed classes in the land than to educate them and to develop in them the sense of their lost individuality in order that they may rise to a better conception of their own dignity as human beings and a better knowledge of the conditions of their existence." Education, more than anything else was then the most important next thing that the boys needed. Accordingly we started a vernacular middle school for the boys. The Settlement has grown up at present to an institution that concentrates the whole attention to the boys and girls that live and study there. Besides the 3 R's. the boys are taught carpentry, weaving, agriculture, tailoring and other cottage industries while the girls are given training in basket making, needle work, etc. The 68 boys live in four cottages and 25 girls in a fifth cottage, far removed from the cottages for the boys. In these cottages they are trained to grow to be young men and women of good Christian character. The cottages are simple buildings with a dormitory, a prayer room, a sick room, a box room and two rooms for the teacher. The teacher lives with the boys and acts as a warden or rather as a father or elder brother. While I was there I had the privilege of living with the boys and sharing with one another our individual lives. There was in my cottage a feeling of joy and happiness, discipline and order and a spirit of brotherliness and service. We follow a definite programme in all the cottages. Special attention is given to individual and corporate prayer, preparation of class lessons, cottage duties, field work and games.

The work is not limited to the few boys and girls, but is extended to the village. We are winning the love of the villagers by running a night school, a co-operative society and by visiting them often. We have only made an approach towards village work and as far as we have approached we have been successful in changing the outlook of the villagers. All the villagers about us have felt the need of better living and have begun to strive after it. As soon as I go back we may be able to help them in their agriculture, dairying, etc.

Out of an intense desire to know more about the work, most of the people that I meet ask me about the financing of the work. To them I answer that the Settlement is run on very inexpensive

lines. The boys and girls are given simple food and simple clothing. Their expenses per head will come to only Rs. 5 per month. The teachers also do not receive the pay they ought to. Maintenance is the standard of pay of the workers. For the last eight years on establishments and current expenses we have spent about Rs. 75,000 and most of this has come by donations. For the current expenditure which amounts to about Rs. 12,000 we have three important sources of income. The first is the means of self-support such as the Settlement store, the Settlement agriculture and industry and a small contribution from the boys. The second source is grants from the Travancore Government and the neighbouring Cochin Government. By these two means we get about Rs. 4,000. For the rest of the current expenditure and for all establishments we depend solely upon friends. Because of the liberal contribution of friends in India and a few abroad, even in the days of greatest financial stress and strain our work was maintained. There is no association or society as yet to support us but our "help cometh from the Lord which made heaven and earth".

The future of the Settlement is carefully observed by all those who take interest in the work. All the workers who have decided to work permanently for the uplift of the people are daily seeing visions about the blooming future of the so-called depreseed classes. Slowly and steadily we are achieving our objects. As soon as I go next April we are planning to give to the boys and the villagers sound training in agriculture, dairying etc. Agriculture, dairying, piggery, poultry farming, etc., have great scope at Alwaye because of its nearness to the Cochin harbour and its possibility to get electricity at a very cheap rate from Pallivasal hydro-electric scheme. If friends come to our aid we are hoping to start these on small scales even next year. After three or four years our boys will begin to go out from the institution as trained leaders, agriculturists, carpenters, weavers, tailors, cobblers, etc. Most of them may go back to their own villages and will impart their knowledge and training to their own people and will try to elevate them from their deplorable condition. The others will be settling down in our land which has been given us by the Government for starting a colony of these boys. For attempting all these pioneering enterprises the workers must be fully trained and the money sufficient for the purposes must be found. The work was started in faith and in His purpose and we know that "the King of love" who hast taken this work in His hands knows all about the needs and will bless us abundantly.

In closing I want to bring home once again the important fact that what India wants in the work of the depressed class people is not more money or organization but men called to love. The cry

of the villager is "we want someone to love us". Let this cry inspire us and make us more loving and "let us put our love into words not into talk but into deeds and make it real".

Vegetable Gardens.

By Ethel Cody Higginbottom

I promised last month that I would tell about the gardens in the Leper Asylum. The smallest of them range from 6×20 ft. and the largest are 29×75 ft. or one-twelvth of a *bigha.* I find that the lepers sow nothing in June until the rains break but they dig the soil with *pharwas* and expose it to the sunlight and dig into it all of the old stalks, leaves, refuse and a little manure. As soon as the rains come they level and put in Maize, Beans, Cowpeas, Okra, bitter gourd (marrow), *chichinda*, chillies, brinjals (egg plant), bottle gourd, pumpkins. The maize is ready in a few weeks and when it is taken out they have room to put in other things. Maize could not be sown in such small plots because of fertilization were it not that several plots containing maize are close together. The ears are full and long and the flavour good. Some of the lepers have now learned to use this maize while it is still in the milk stage as we do in America. The milk stage is shown by puncturing the kernel of the grain with the finger nail or something sharp and a milky fluid exudes. In that stage in America we simply immerse the whole ear after husking in water, not more than enough to cover it. Then we boil them for 4 or 5 minutes, turn it over on the other side and boil a few minutes longer. Ten or fifteen minutes is all that is required to properly cook corn at this stage. It should then be rubbed with butter and salt and eaten from the ear. There are other ways of cooking this corn and if any of our Indian friends desire to know, I will be glad to tell them.

As soon as the maize or corn is out of the ground the lepers sow garlic, *palak* (spinach), methi, and radishes. When the radishes and spinach are used, tomatoes, peas and cauliflowers are put in. I have seen people day after day gather from a very small plot enough vegetables for one meal; often times for two people, one or two egg plants or a *lauki*, some onions or garlic and a few sprigs of spinach which make a good curry and supply the necessary vitamins and vegetable salts which are needed in the diet of the ordinary person. Considering the emaciated condition in which most of these lepers enter our asylum and the fact that they only get one pound of rice or *ata* (whole wheat flour) per person

per day and one anna to spend in the little asylum shop, with which they mostly buy oil, salt, *dal* and spices, our lepers get strong and healthy while in the asylum. They used to say that it was because the water of the asylum wells was good that they improved so much after coming to our asylum. But doctors working on leprosy discovered the value of vegetables in building up the constitution to help on the treatment. Very few open sores continue and we see good results among most of those taking treatment in the asylum. Of course there are a few people who continue to eat *dal* and *roti* and *dal bhat* regardless of any persuasion, except an occasional vegetable meal and these people do not improve as rapidly. They are also people who do not want to take an interest in gardens; to be sure they are sick and deformed so gardening is not easy. But those who make the effort, find that their gardens afford an interest in life, are given a variety in their diet and altogether is very well worth while. This is my hope for the villages of India If we can only persuade them to start little plots in their courtyards or *angans*, if they have no space which can be protected outside, I believe they will soon feel the advantage in health and resistance to disease.

In China soya beans are the standby. They say many babies are saved by drinking the milk made from the soya beans, orby the mothers chewing vegetables in their own mouths and putting into their babies mouths. I think many of our village babies in India for whom there is little milk during the hot weather could be saved by vegetables or the water from vegetables in preference to *dal* and coarse bread. To this end let us work.

While this issue was in the press, we saw in the daily papers that a meeting of the United Provinces Cattle Breeding Committee was held at the Bharari Cattle Farm (district Jhansi) on August 22, in which one of the items discussed was the systematic castration of scrub bulls. This, we regard, would be a step in the right direction. [EDITOR A. F.]

METEOROLOGICAL OBSERVATIONS AT THE ALLAHABAD AGRICULTURAL INSTITUTE

August, 1935

Date.	Maximum Temperature.	Minimum Temp.	Mean Temp.	Percentage of Humidity.	Atmospheric Pressure	Rain for the day.	Rain since Jan. 1	Wind direction.	Remarks
1	92	79	85·5	82	29·13	0·39	20·77	E.	
2	94	82	88·0	80	29·12	Nil	20·77	E.S.E.	
3	91	78	84·5	90	29·14	0·45	21·21	W.	
4	92	78	85·0	92	29·15	Nil	12·21	E.	
5	88	81	84·5	90	29·14	0·13	21·34	Calm	
6	89	79	84·0	94	29·14	1·27	22·61	E.	
7	87	78	82·5	96	29·14	0·68	23·29	W.N.W.	
8	83	76	79·5	96	29·18	2·94	26·23	W.	
9	77	75	76·0	98	29·18	1·50	27·73	E.S.E.	
10	79	75	77·0	96	29·21	0·51	28·24	W.	
11	84	76	80·0	92	29·24	0·04	28·26	W.	
12	87	76	81·5	90	29·24	trace	28·26	W.	
13	81	76	78·5	92	29·26	0·09	28·37	W.	
14	83	75	79·0	96	29·19	4·23	32·60	N.W.	
15	80	76	78·0	88	29·23	0·23	32·83	E.S.E.	
16	85	76	80·5	95	29·34	0·22	33·05	E.S.E.	
17	85	77	81·5	90	29·34	Nil	33·05	W.	
18	85	78	81·5	85	29·34	Nil	33·05	E.	
19	89	80	84·5	82	29·31	0·04	33·09	W.	
20	86	79	82·5	90	29·28	0·75	33·84	W.	
21	89	79	84·0	80	28·26	0·06	33·90	W.	
22	90	80	85·0	80	29·26	Nil	,,	W.	
23	92	80	86·0	77	29·35	,,	,,	W.	
24	91	79	85·0	76	29·33	,,	,,	W.	
25	86	78	82·0	72	29·34	,,	,,	N.N.W.	
26	93	78	85·5	72	29·32	,,	,,	W.	
27	94	78	86·0	70	29·26	,,	,,	W.	
28	95	80	87·5	68	29·28	,,	,,	W.	
29	95	81	88·0	70	29·28	,,	,,	W.	
30	95	79	87·0	74	29·32	0·11	34·01	E.S.E.	
31	92	81	86·5	74	29·39	trace	,,	E.	

September, 1935

Date.	Max. Temp	Min. Temp.	Mean Temp.	Percentage of Humidity.	Atmospheric Pressure	Rain for the day.	Rain since Jan. 1	Wind direction.	Remarks.
1	92	81	86·5	80	29·32	0·13	34·14	E.	
2	81	78	82·5	83	29·29	0·05	34·19	E.	
3	90	80	85·0	84	29·28	0·14	34·33	S W.	
4	94	80	87·0	82	29 24	Nil.	34·33	W.S.W.	
5	95	80	87·5	84	29·20	0·02	34·35	W.N.W.	
6	88	74	81·0	96	29·21	1·17	35·52	W.	
7	89	75	82·0	80	29·18	,,	35·52	W.	
8	94	75	84·5	85	29·19	0·13	35·65	N.W.	
9	87	79	83·0	84	29·22	0 02	35 67	E.N.E.	
10	92	80	86·0	77	29·20	Trace	,,	E.N.E.	
11	94	78	86·5	74	29·22	Nil.	,,	,,	
12	95	80	87·5	78	29·26	,,	,,	,,	
13	94	80	87·0	85	29·34	0·16	35·83	,,	
14	92	79	85·5	79	29·32	Nil.	,,	E.	
15	94	80	87·0	80	29·26	,,	,,	E.	
16	93	80	86·5	82	29·20	,,	,,	E.	
17	89	78	83·5	88	29·20	0·12	35·95	E.	
18	86	76	81·0	98	29·23	4·23	40·18	E.	
19	82	76	79·0	96	29·24	0·07	40·25	E.N.E.	
20	83	76	79·5	95	29·27	0·28	40·53	N.W.	
21	83	77	80·0	98	29·30	0·18	40·71	N W.	
22	79	76	77·5	94	29·31	2·29	43·00	W.	
23	89	76	82·5	80	29·33	Nil.	,,	W.	
24	89	75	82·5	82	29·35	,,	,,	W.	
25	90	76	83·0	76	29·36	,,	,,	W.	
26	90	75	82·5	70	29·38	,,	,,	W.	
27	90	75	82·5	69	29·37	,,	,,	W.	
28	90	74	82,0	66	29·40	,,	,,	W.	
29	89	73	81·0	67	29·42	,,	,,	W.	
30	90	73	81 5	68	29·42	,,	,,	W.	

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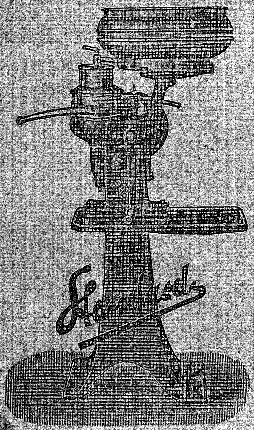

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